OEM Starter Frame and Components

Allen-Bradley

Bulletin 1503

2400 to 7200 volts

Installation Manual

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the Additional Resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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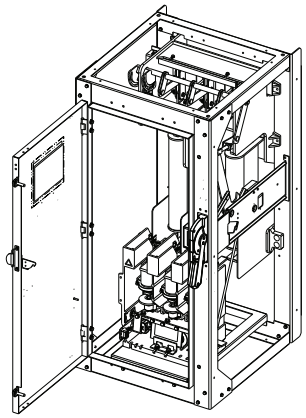


OEM Starter Frame Installation

ATTENTION

Read this document before performing any installation procedures or adjustments. Observe all applicable safety procedures when working on the equipment. Complete all installation procedures before connecting the incoming line cable. Failure to do so may result in damage to the equipment or injury to personnel.

Receiving

Refer to ***General Handling Procedures for Medium Voltage Controllers – Publication MV-QS050_-EN-P***. This document is included with your shipment and contains information regarding receiving, unpacking, initial inspection, handling, storage, opening the medium voltage doors, and site preparation.

Note: Refer to Appendix A for a listing of the items that are included in your OEM Frame Kit.

Installation

Standards and Codes

IMPORTANT The OEM starter frame consists of a fusible non-load-break isolation switch, an isolation switch handle, a vacuum contactor, control circuitry and a medium voltage door. These components are not a complete motor controller. The user must add appropriate control circuitry for the application, power fusing, current transformer, control power transformer, overload protection and a suitable enclosure. It is recommended that the user be familiar with the following safety and design standards and codes, and any additional local codes that a medium voltage starter must comply with.

- CEC (Canadian Electrical Code)
- CSA 22.2 No. 14 (Canadian Standards Association) – Industrial Control Equipment
- NEC (National Electrical Code)
- NEMA ICS Standards (National Electrical Manufacutrers' Association)
- OSHA (Occupational Safety and Health Administration)
- UL 50 (Underwriters Laboratories) – Enclosures for Electrical Equipment
- UL 347 (Underwriters Laboratories) – High voltage Industrial Control Equipment
- UL 508 (Underwriters Laboratories) – Industrial Control Equipment
- IEC 60204-1 – Safety of Machinery – Electrical Equipment of Machines, Part 1: General Requirements
- IEC 62271-200 – AC Metal Enclosed Switchgear and Control Gear for Rated Voltages Above 1kV and up to 52 kV
- IEC 60470 – High Voltage Alternating Current Contactors
- IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code)
- IEC 62271-1 – Common Clauses for High voltage Switchgear and Control Gear Standards

Installation (Cont.)

Standards and Codes (Cont.)

The OEM starter frame assembly was fully tested and inspected at the factory. Unless damage from shipping is suspected, the commissioning procedures in Chapter 4 of this manual should be the only additional checks required for the unit.

Imperial Tool Requirements

IMPORTANT Some components of this product incorporate Imperial hardware. Rockwell Automation recommends the use of the appropriate tools to successfully complete the assembly and maintenance procedures for these components. If you cannot obtain such tools, contact your area Rockwell Automation sales office for assistance.

The following Imperial size tools are recommended for installation and maintenance of the OEM starter frame and components:

- Standard drive ratchet with extension
- Standard drive torque wrench
- Standard drive sockets: 9/32, 3/8, 7/16, 1/2, 9/16, 3/4 in.
- Open-end wrenches: 7/16, 1/2, 9/16, 11/16, 3/4, 7/8 in.
- Drill and drill bits: 0.172, 0.219, 0.281 in.
- Slot-head screwdrivers
- Feeler gauge set (0.125 in to 0.300 in.)
- Locking pliers
- High potential tester

Metric Tool Requirements

IMPORTANT Metric equivalent sizes are provided in parentheses where applicable. It is important to note that all sizes given are not exact substitutes for the corresponding Imperial sizes. To ensure proper installation, use the recommended metric hardware and dimensions for pilot holes and clearance holes.

The following metric size tools are recommended for installing the OEM frame and components with metric hardware.

- Standard drive ratchet with extension
- Standard drive torque wrench
- Standard drive sockets: 8, 10, 13, 15, 18 mm
- Open-end wrenches: 8, 10, 13, 15, 18 mm
- Drill and drill bits: 4.6, 5.5, 6.8 mm
- Slot-head screwdrivers
- Locking pliers
- Feeler gauge set (3mm to 8 mm)
- High potential tester

400 Amp Starter Frame Dimensions

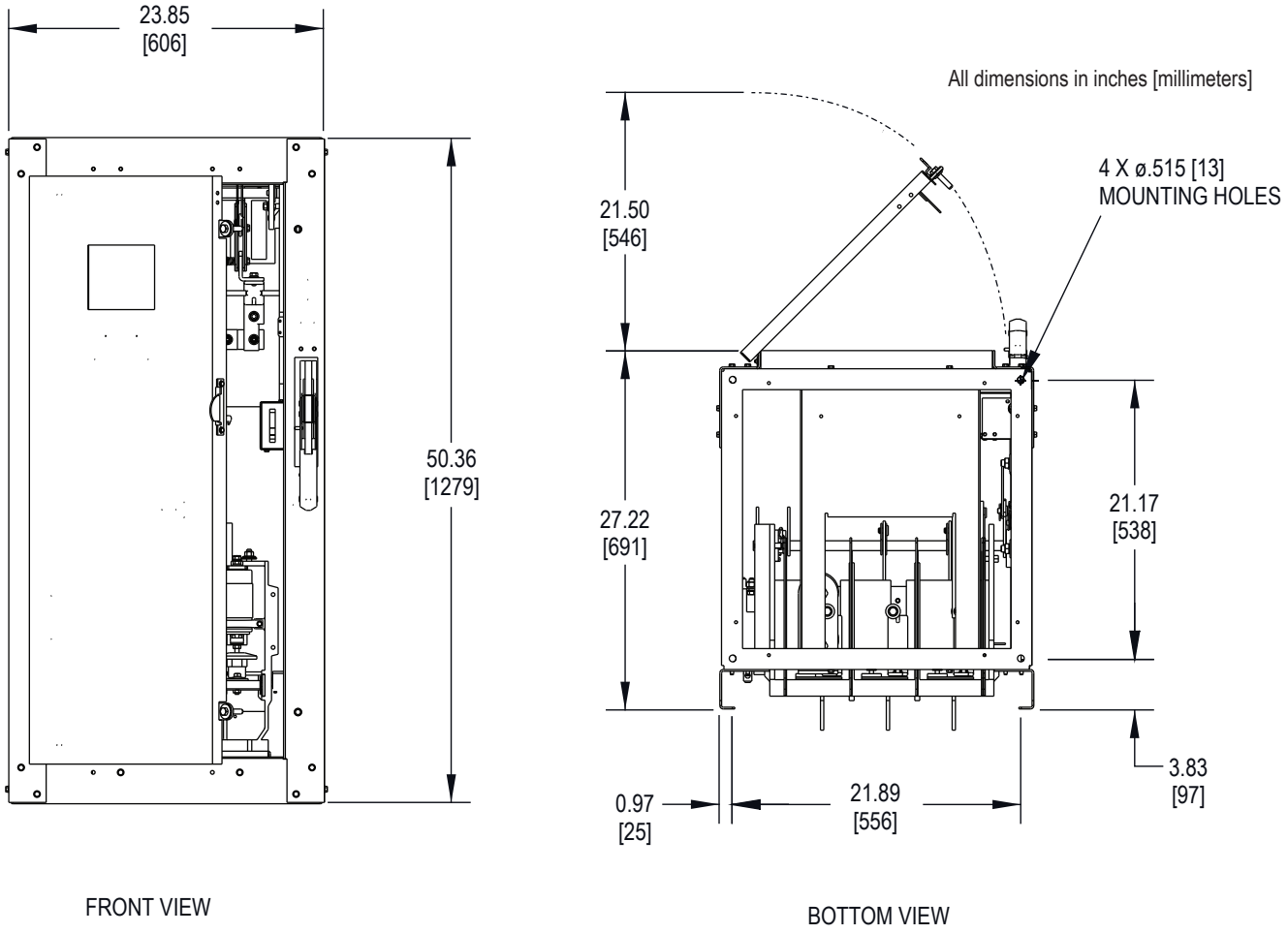
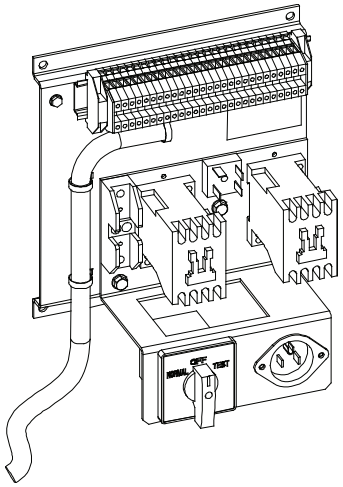


Figure 1.1 – Starter Frame Dimensions



Control Panel

1) Mount the control panel in a suitable location. Be aware that the control plug wiring harness is 10 ft. (3 meters) in length. Ensure that the wiring harness route still allows for a proper connection to the contactor control plug.

2) Connect the control panel harness to the receptacle on the left side of the contactor. Observe the matching number codes to ensure a proper connection. See Control Panel, page 2-10, for more information and for wiring diagrams.

Installation (Cont.)

IntelliVAC

Refer to Publication 1503-UM051_-EN-P or 1503-UM052_-EN-P for IntelliVAC mounting instructions. Note that a suitable wire harness is required (1503-WHxxx) to connect IntelliVAC to the vacuum contactor.

Refer to “IntelliVAC”, page 2-10 for more information and wiring diagrams.

Torque Requirements

Use the specified torque values for all hardware whenever performing maintenance or attaching components.

1/4 in. (M6) hardware	6 ft•lb (8 N•m)
5/16 in. (M8) hardware	12 ft•lb (15 N•m)
3/8 in. (M10) hardware	20 ft•lb (27 N•m)
1/2 in. (M12) hardware	48 ft•lb (65 N•m)

Fuses

Refer to the motor nameplate for the information necessary to determine correct power fuse size. See page 2-7 for recommended power fuses.

ATTENTION

Only qualified personnel should select the fuse type and rating. Failure to select the correct fuses may result in injury to personnel and/or damage to equipment.

1) Install clip-on or bolt-on power fuses into the isolation switch fuse clips.
2) If control power is supplied by control power transformer within the unit, fuses may be installed in the control circuit transformer primary fuse clips at the top of the contactor (see page 2-24 for details).

Line and Load Connections

See Incoming Line Connections (page 2-24) and Load Connections (page 2-24).

Commissioning

See Commissioning, Chapter 4.

Component Installation for 400A Equipment

Component Layout

Refer to the following diagram to determine the location of the OEM components relative to each other.

IMPORTANT The mounting location of the trailer fuse block varies depending on the type of power fuses used by the unit. Figure 2.1 shows the component configuration for units using clip-on power fuses and Figure 2.2 shows the component configuration for units using bolt-on power fuses.

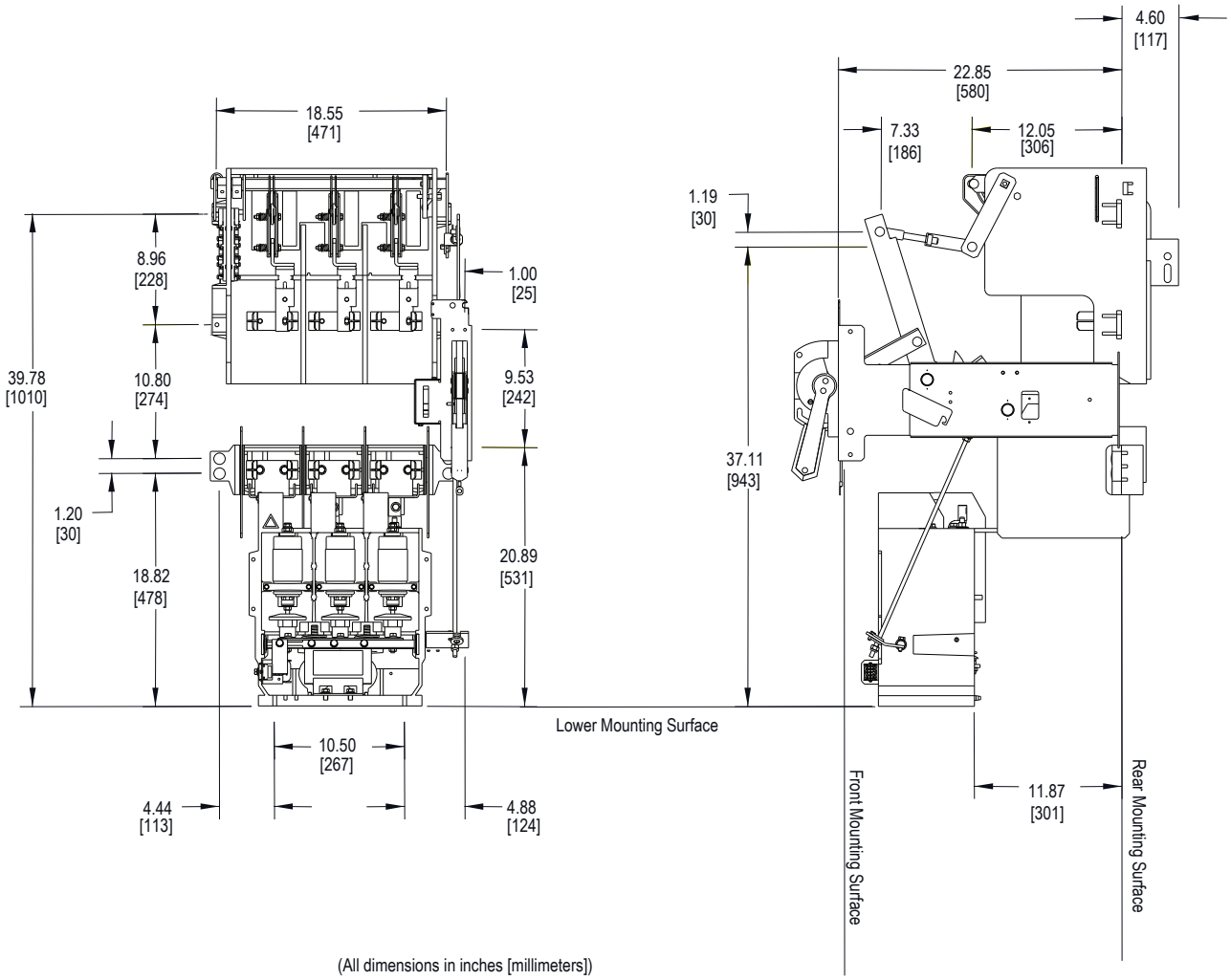


Figure 2.1 – OEM Component Layout (Clip-on Power Fuses)
(Frame and other parts not shown)

Component Layout (cont.)

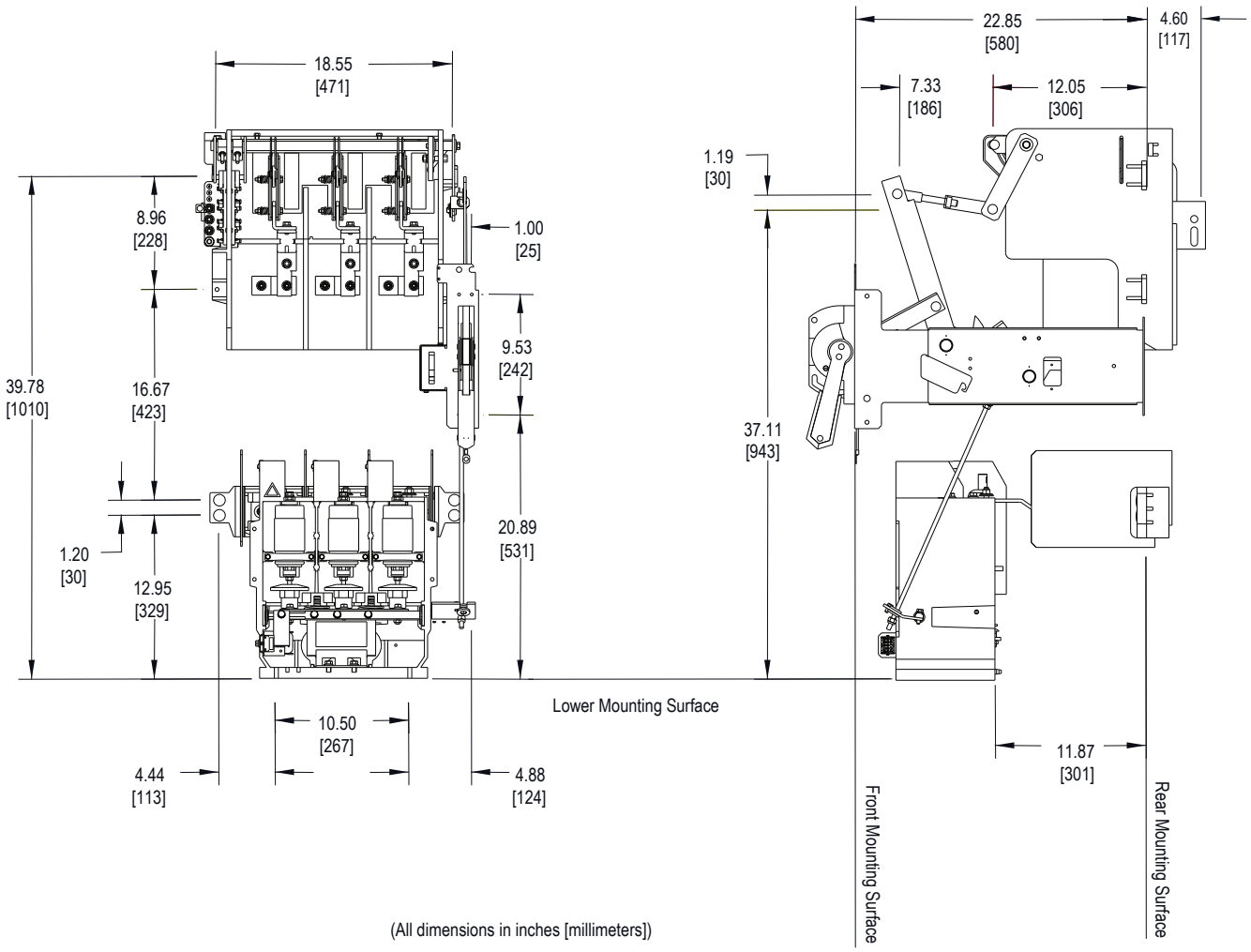
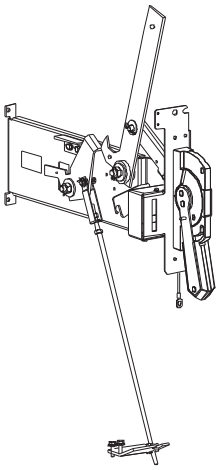


Figure 2.2 – OEM Component Layout (Bolt-on Power Fuses)
(Frame and other parts not shown)

Mounting Isolation Switch Handle Module



Isolation Switch Handle (OFF Position)

IMPORTANT The handle is shipped in the OFF, or open, position. All instructions assume the handle remains in the OFF position during installation and adjustment procedures unless otherwise stated.

Required Hardware:

- Six (6) ¼-20 x 0.5 in. (6.3 x 1.8 x 13mm Type B) self-tapping screws
- One (1) 5/16 in. (M8 x 1.25) grounding wire screw

Refer to the component layout shown in Figure 2.1 or 2.2 to determine the mounting location and the location of the mounting holes for the isolation switch handle module. Refer to Figure 2.3 for a detailed view of the mounting holes.

1) Prepare a cut-out in the cabinet for the handle using the dimensions shown in Figure 2.3.
2) Drill four (4) 0.281-in. (6.8 mm) clearance holes in the locations indicated for the retaining screws.

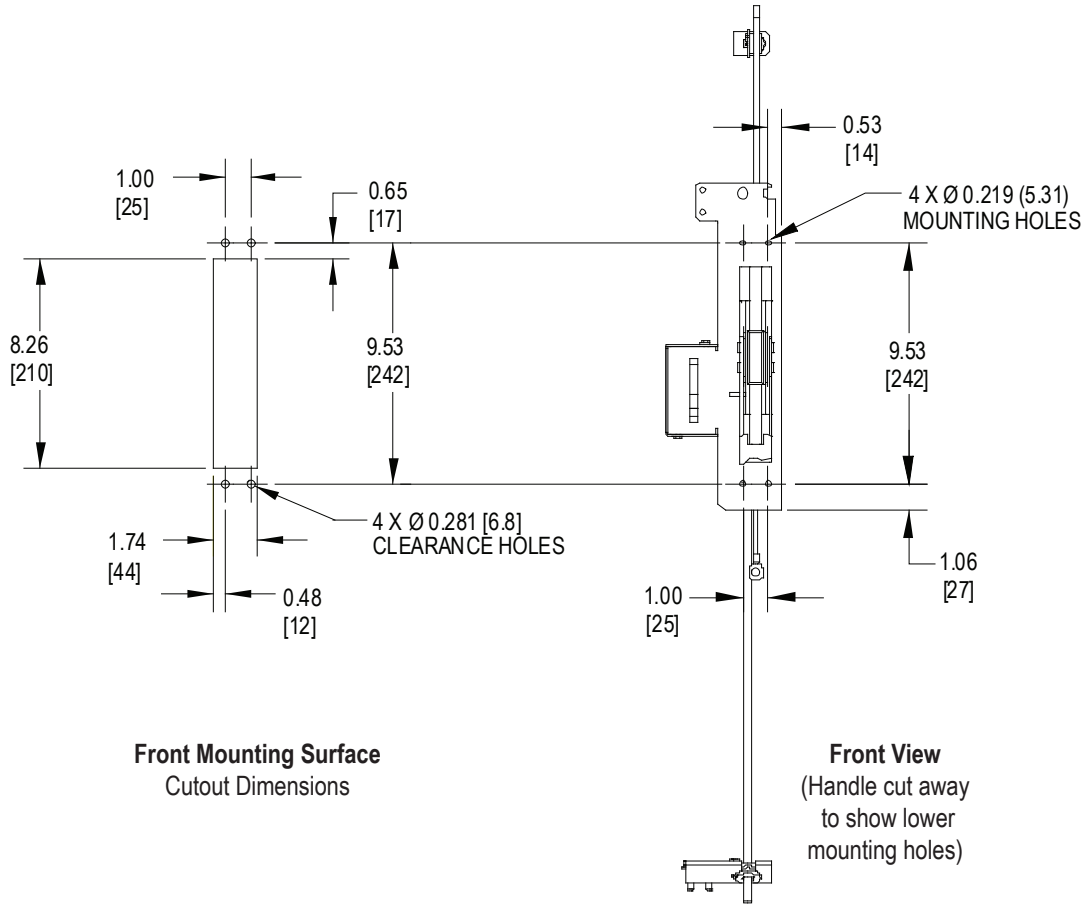


Figure 2.3 – Handle Cut-out Dimensions

Mounting Isolation Switch Handle Module (cont.)

3) From the inside of the cabinet, insert the handle through the cut-out and line up the pilot holes with the pre-drilled holes in the handle assembly. Use four (4) ¼-20 (6.3 x 1.8 Type B) self-tapping screws to attach the front of the handle. Torque the screws according to the specifications shown on page 1-4.
4) Mark the location of the rear mounting tabs of the handle module. Drill two (2) 0.219-in. (5.5mm) pilot holes (see Figure 2.4).

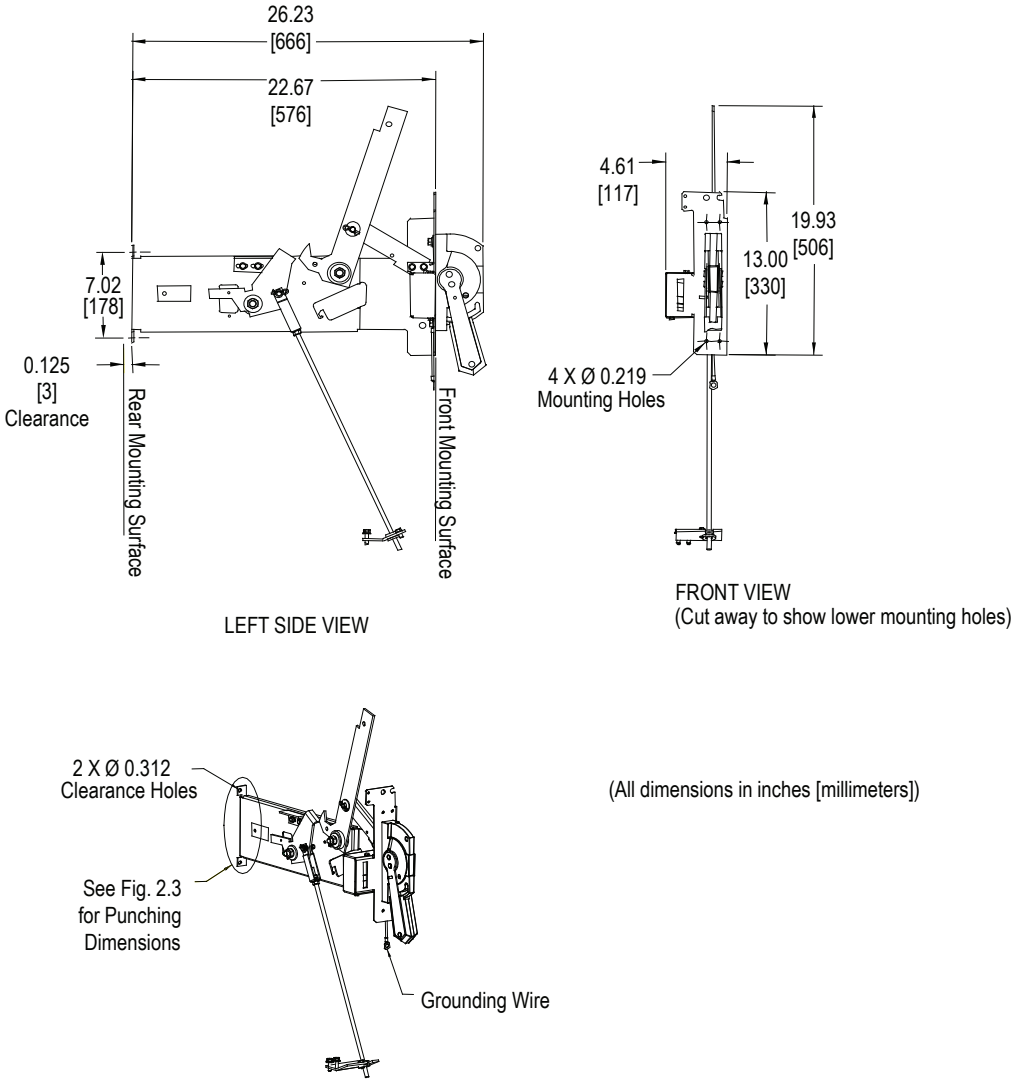


Figure 2.4 – Mounting Rear of Isolation Switch Handle Module

5) Install two (2) ¼-20 (6.3 x 1.8 Type B) self-tapping screws in the tabs at the end of the handle module to attach it to the rear of the cabinet. Torque the screws according to the specifications shown on page 1-4.

IMPORTANT The rear mounting tabs may deform slightly when secured to the mounting surface. The deformation is normal and helps to reduce any gap between the handle module and the mounting surface.

6) Connect the green grounding wire to a suitable grounding surface.

Mounting Isolation Switch and Trailer Fuse Block

Refer to the component layout shown in Figure 2.1 or 2.2 to determine the location of the isolation switch. Refer to Figure 2.6 to determine the location of the mounting holes for the isolation switch.

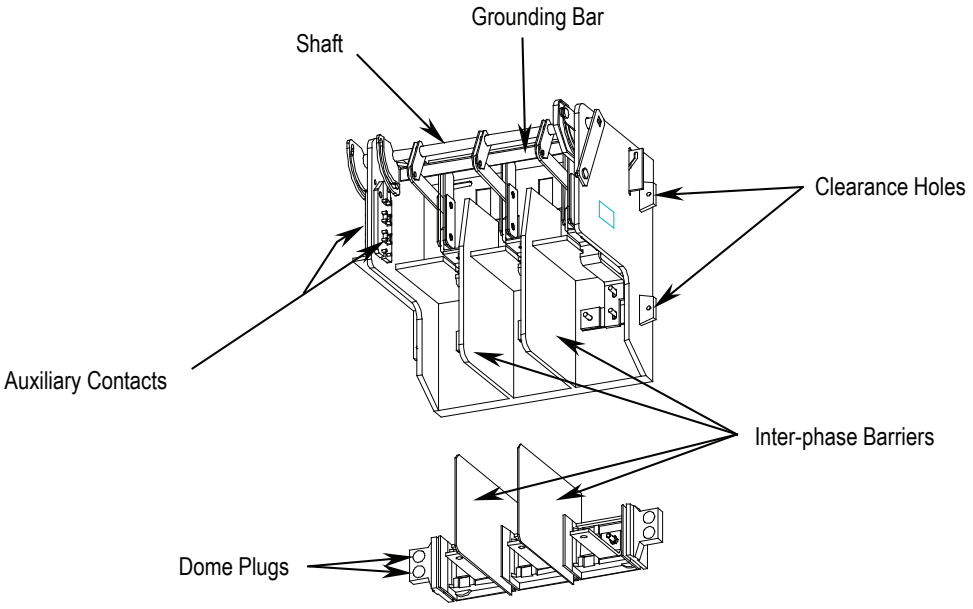


Figure 2.5 – Typical Isolation Switch

Required Hardware:

– Eight (8) ¼-20 x 1.0 in. (6.3 x 1.8 x 25mm Type B) self-tapping screws
– Four (4) dome plugs (supplied)

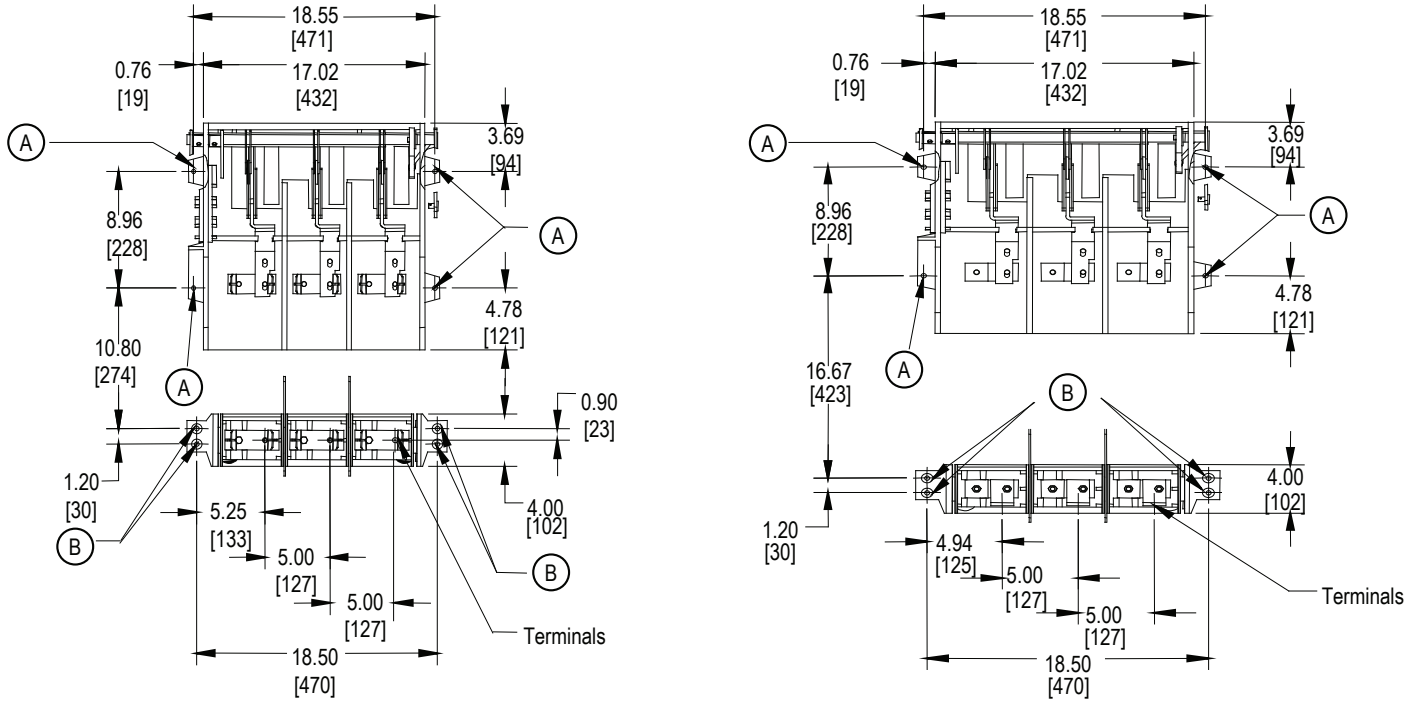
1) Drill four (4) 0.219 in. (5.5 mm) pilot holes in the mounting surface at Location A as shown in Figure 2.6 for the isolation switch.
2) Attach the isolation switch using four (4) ¼-20 (6.3 x 1.8 Type B) self-tapping screws. Torque the screws according to the specifications

Mounting Isolation Switch and Trailer Fuse Block (cont.)

Refer to the component layout shown in Figure 2.1 or 2.2 to determine the location of the trailer fuse block. Refer to Figure 2.6 to determine the location of the mounting holes for the trailer fuse block.

1) Drill four (4) 0.219 in. (5.5 mm) pilot holes at Location B as shown in Figure 2.6 for the trailer fuse block.
2) Attach the trailer fuse block using four (4) ¼-20 (4.8 x 1.6 Type B) self-tapping screws. Torque the screws according to the specifications shown on page 1-4.
3) Install a dome plug over each screw.

ATTENTION Reinstall any inter-phase barriers that were removed while connecting the trailer fuse block. Failure to do so may produce an electrical fault between the fuses and damage the equipment.



FRONT VIEW (CLIP-ON FUSES)
(Cut away to show upper mounting tabs)

FRONT VIEW (BOLT-ON FUSES)
(Cut away to show upper mounting tabs)

(A) Ø 0.310 Isolation switch clearance hole location

(B) Ø 0.310 Trailer fuse block clearance hole location

(All dimensions in inches [millimeters])

Figure 2.6 – Orientation of Isolation Switch

Power Fuses

Ferraz-Shawmut medium voltage power fuses are recommeded for the Bulletin 1503. These motor fuses have been tested and meet the co-ordination requirements for the Bulletin 1502 vacuum contactor. The fuses many be purchsed from Rockwell Automation, Ferraz-Shawmut, or from a local distributor. The following part numbers are available. (See Figures 2.7 and 2.8 for dimensions of fuses.)

Table 2.1 – Recommended Power Fuses

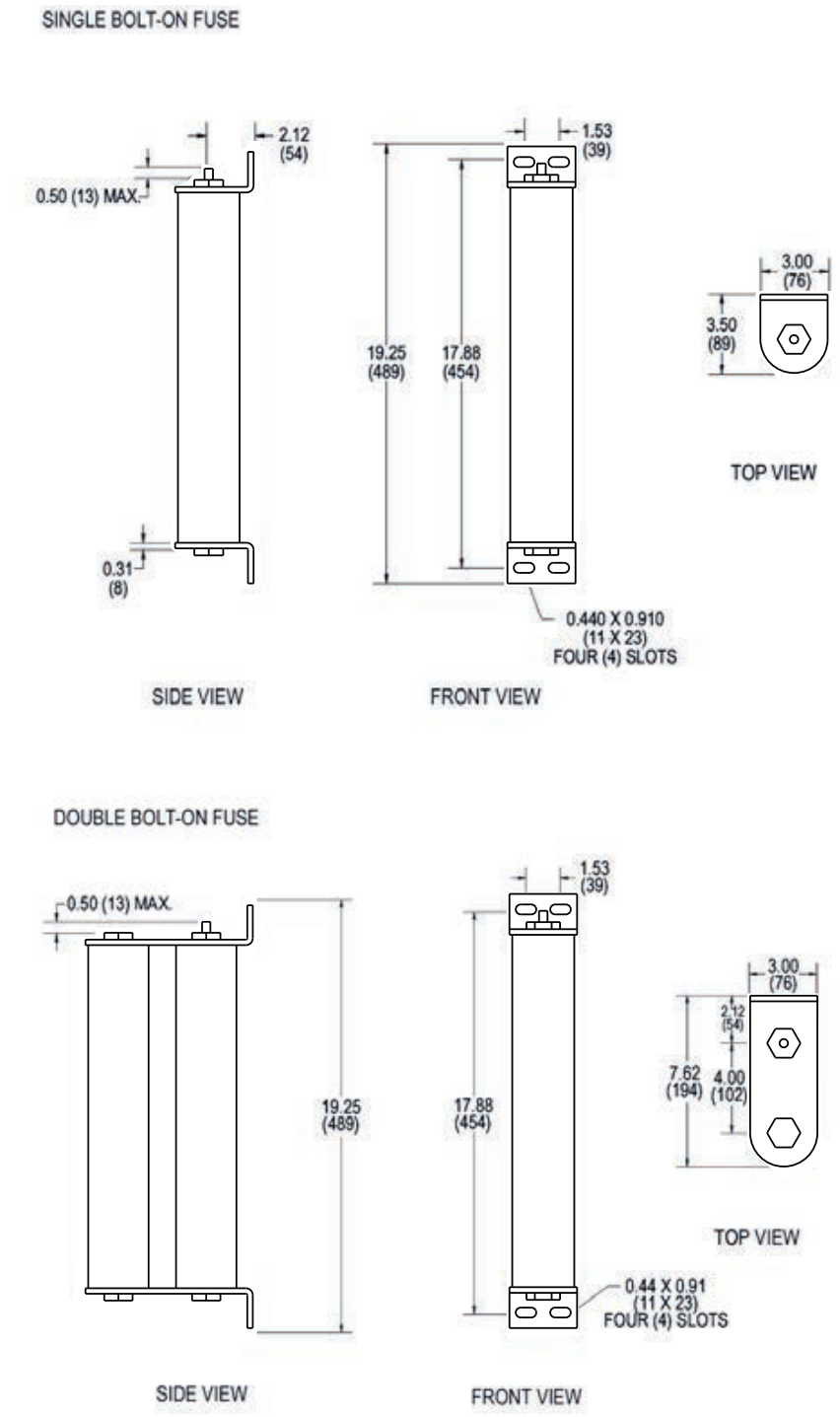
Fuse Rating ❸	Clip-on Fuses			
	5 kV Allen-Bradley Part Number	5 kV Ferraz-Shawmut Part Number	7.2 kV Allen-Bradley Part Number	7.2 kV Ferraz-Shawmut Part Number
2R, 70 A	25173-555-01 ❶	A480R-2R ❶	80025-650-01 ❶	A072F1DORO-2R ❶
3R, 100 A	25173-555-02 ❶	A480R-3R ❶	80025-650-02 ❶	A072F1DORO-3R ❶
4R, 130 A	25173-555-03 ❶	A480R-4R ❶	80025-650-03 ❶	A072F1DORO-4R ❶
6R, 170 A	25173-555-04 ❶	A480R-6R ❶	80025-650-05 ❶	A072F1DORO-6R ❶
9R, 200 A	25173-555-05 ❶	A480R-9R ❶	80025-650-06 ❶	A072F1DORO-9R ❶
12R, 230 A	25173-555-06 ❶	A480R-12R ❶	80025-650-07 ❶	A072F1DORO-12R ❶
18R, 390 A	25173-555-07 ❷	A480R-18R ❷	80025-691-01 ❷	A072F1DORO-18R ❷
24R, 450 A	25173-555-08 ❷	A480R-24R ❷	80025-691-02 ❷	A072F1DORO-24R ❷

❶ Single-Barrel Fuse
❷ Double-Barrel Fuse. OEM must provide means to prevent fuse rotation under fault conditions.
❸ Continuous ampere rating at 40°C (104°F) as recommended by fuse manufacturer.
The fuse rating must be derated if the internal temperature will exceed 40°C (104°F). Rockwell Automation recommends that the continuous load current not exceed 80% of the fuse rating.

Fuse Rating ❸	Bolt-on Fuses			
	5 kV Allen-Bradley Part Number	5 kV Ferraz-Shawmut Part Number	7.2 kV Allen-Bradley Part Number	7.2 kV Ferraz-Shawmut Part Number
2R, 70 A	80025-296-01 ❶	A051B1DARO-2R ❶	80026-690-01 ❶	A072B1DARO-2R ❶
3R, 100 A	80025-296-02 ❶	A051B1DARO-3R ❶	80025-690-02 ❶	A072B1DARO-3R ❶
4R, 130 A	80025-296-03 ❶	A051B1DARO-4R ❶	80025-690-03 ❶	A072B1DARO-4R ❶
6R, 170 A	80025-296-04 ❶	A051B1DARO-6R ❶	80025-690-05 ❶	A072B1DARO-6R ❶
9R, 200 A	80025-296-05 ❶	A051B1DARO-9R ❶	80025-690-06 ❶	A072B1DARO-9R ❶
12R, 230 A	80025-296-06 ❶	A051B1DARO-12R ❶	80025-690-07 ❶	A072B1DARO-12R ❶
18R, 390 A	80025-296-07 ❷	A051B1DARO-18R ❷	80025-651-01 ❷	A072B2DARO-18R ❷
24R, 450 A	80025-296-08 ❷	A051B1DARO-24R ❷	80025-651-02 ❷	A072B2DARO-24R ❷

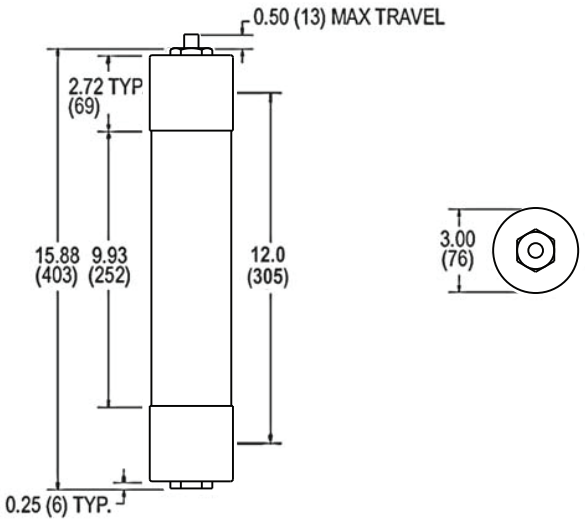
❶ Single-Barrel Fuse
❷ Double-Barrel Fuse.
❸ Continuous ampere rating at 40°C (104°F) as recommended by fuse manufacturer.
The fuse rating must be derated if the internal temperature will exceed 40°C (104°F). Rockwell Automation recommends that the continuous load current not exceed 80% of the fuse rating.

Power Fuses (cont.)

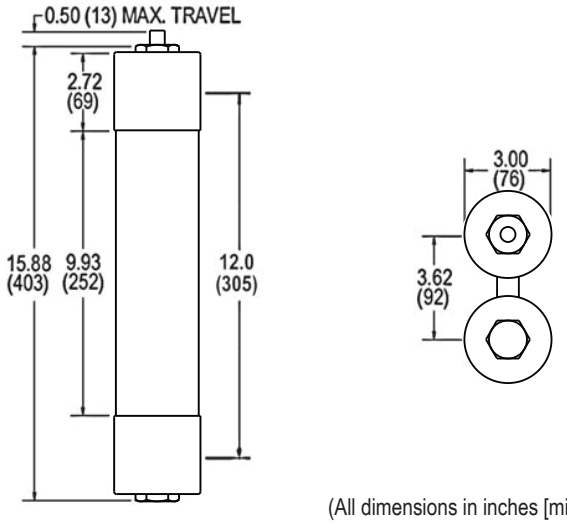


(All dimensions in inches [millimeters])

Figure 2.7 – Bolt-on Fuse Dimensions



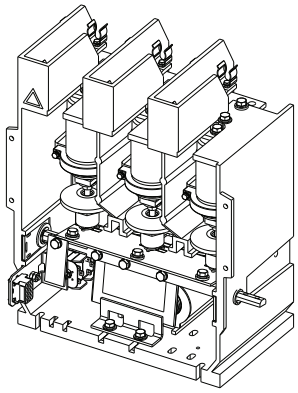
DOUBLE CLIP-ON FUSE



(All dimensions in inches [millimeters])

Figure 2.8 – Clip-on Fuse Dimensions

Contactor



Refer to the following publications for the Bulletin 1502 Medium Voltage Contactor:

- ***400A –*** Publication 1502-UM050_EN-P (Series D)
- ***400A*** – Publication 1502-UM052_EN-P (Series E)
- ***800A –*** Publication 1502-UM051_EN-P (Series E)

These user manuals contain detailed information on installation, adjustment and maintenance for this product.

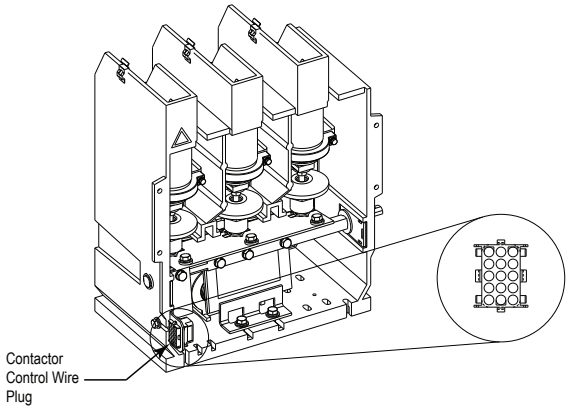
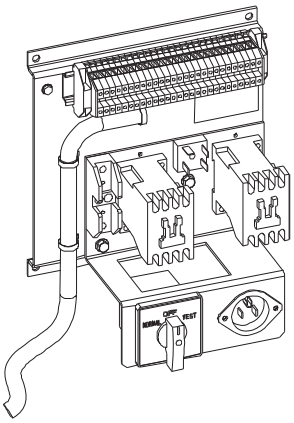


Figure 2.9 – 120V and 230V Control Wire Plug Location and Configurations

Note: Refer to the appropriate vacuum contactor User Manual for detailed wire plug pin configurations.

Control Panel



Required Hardware:

– Four (4) 1/4-20 x 0.5 in. (6.3 x 1.8 x 13mm Type B) self-tapping screws

Mount the control panel in a suitable location. Be aware that the control plug wiring harness is 10 ft. (3 meters) in length. Ensure that the wiring harness route still allows for a proper connection to the contactor control plug.

Connect the control panel harness to the contactor control wire plug on the lower left side of the contactor. The number codes on the plug must line up with those on the contactor to ensure a proper connection. See Figure 2.9.

Use the terminal blocks on the control panel to connect the unit to a 120- or 230-volt grounded power source (whichever is applicable to the control panel) and to other remote devices - see Figure 2.10 or 2.12 for electrical drawings.

IntelliVAC

Refer to Publication 1503-UM051_EN-P or 1503-UM052_-EN-P for information regarding the IntelliVAC control module. Refer to Figure 2.12 or 2.13 for typical electrical drawings.

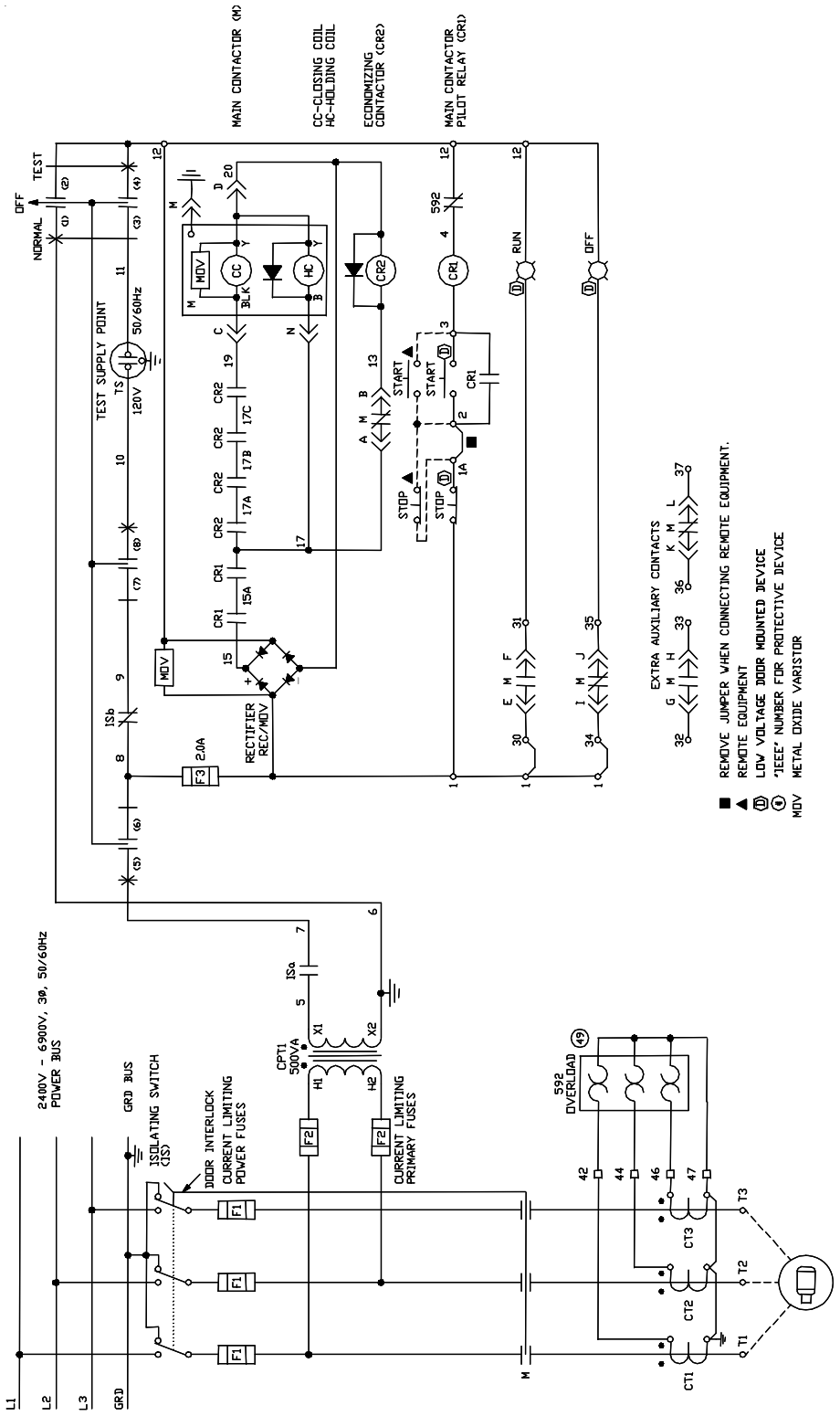


Figure 2.10 – Typical Schematic Diagram for 400 amp Full-Voltage Non-Reversing (FVNR) Controller *with* Electro-Mechanical Control and Electrically Held Contactor, 120 V AC (Normal Drop-out Time)

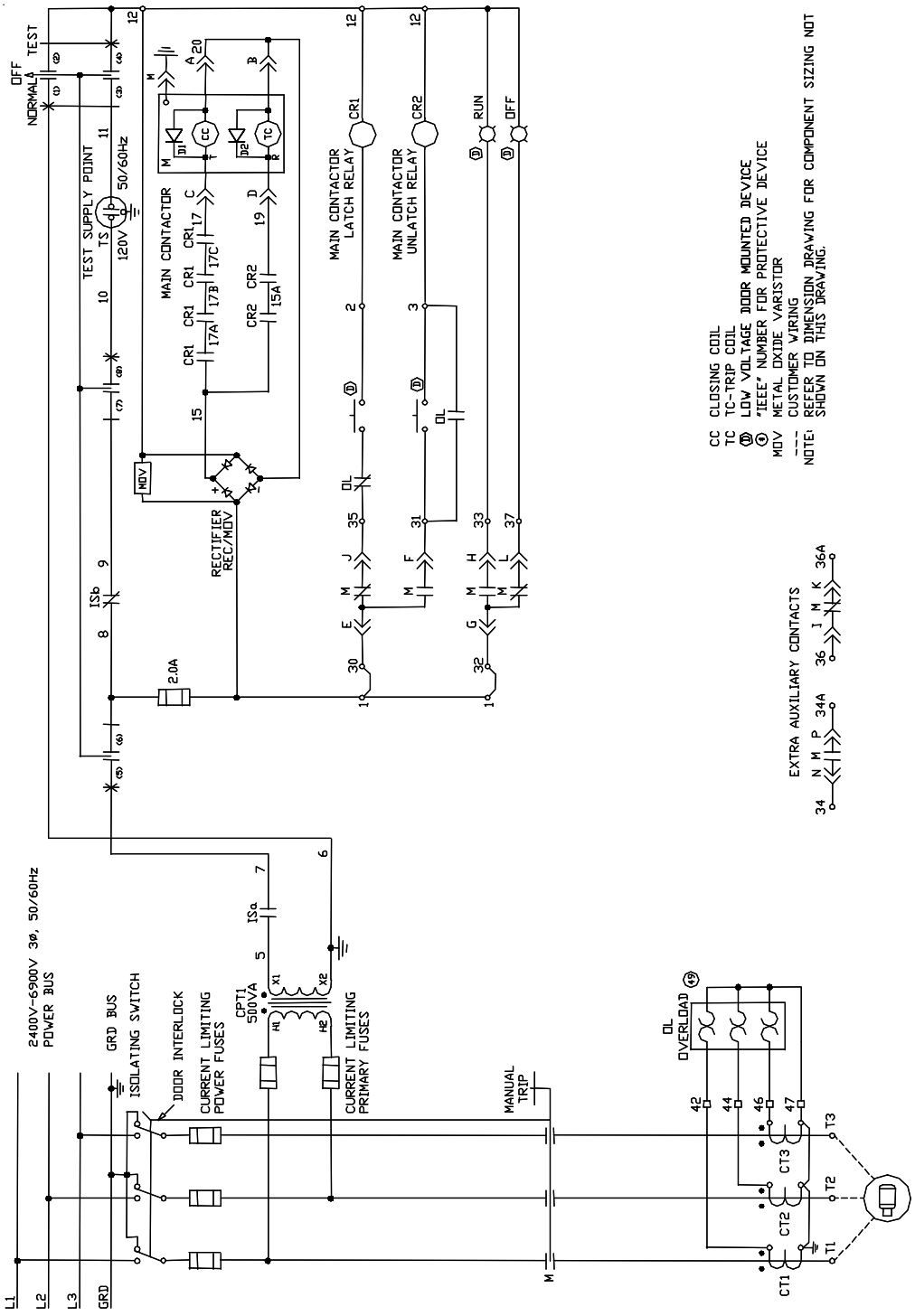


Figure 2.11 – Typical Schematic Diagram for 400A Full-Voltage Non-Reversing (FVNR) Controller *with* Electro-Mechanical Control and Mechanical Latch Contactor

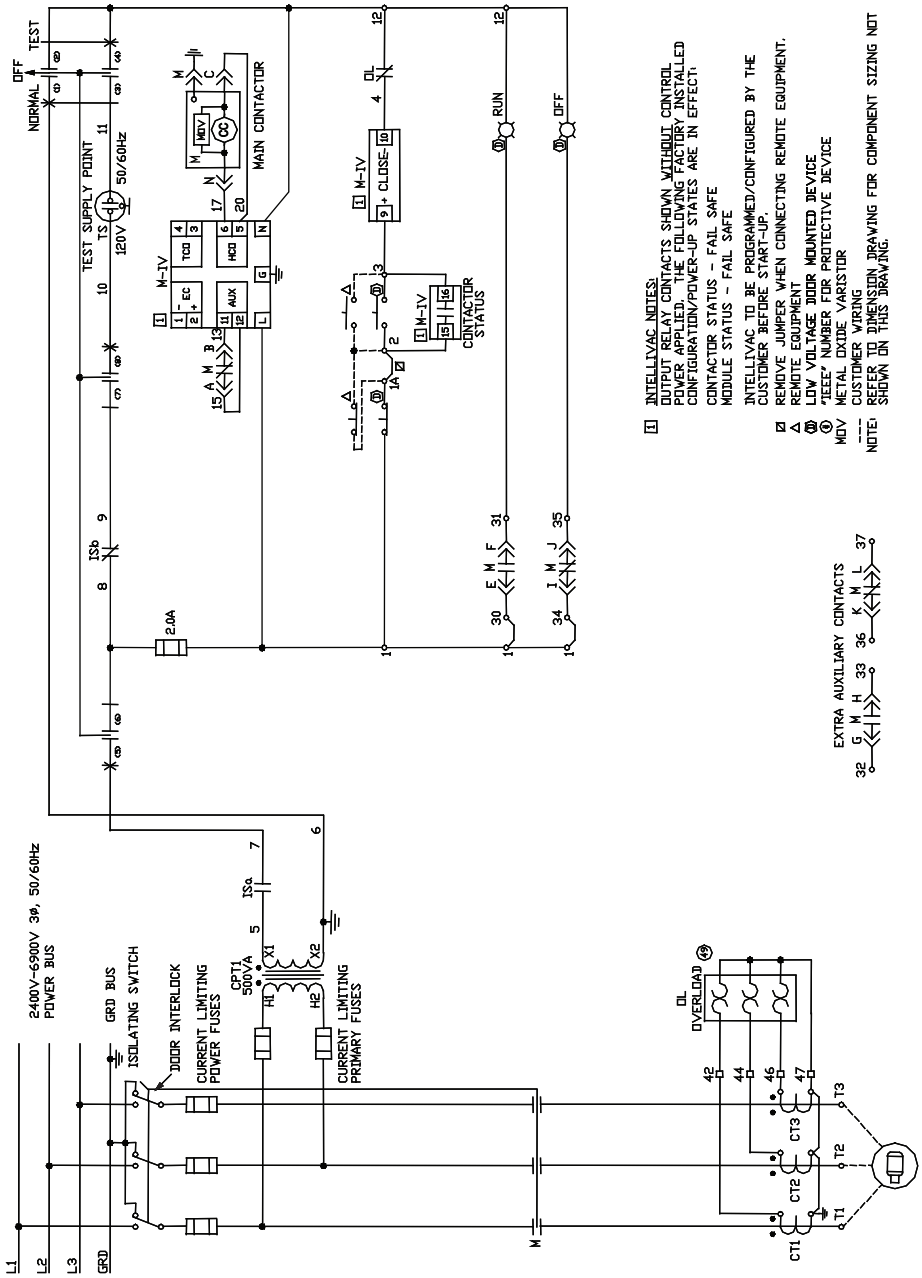


Figure 2.12 – Typical Schematic Diagram for 400A Full-Voltage Non-Reversing (FVNR) Controller *with* IntelliVAC Control and Electrically Held Contactor

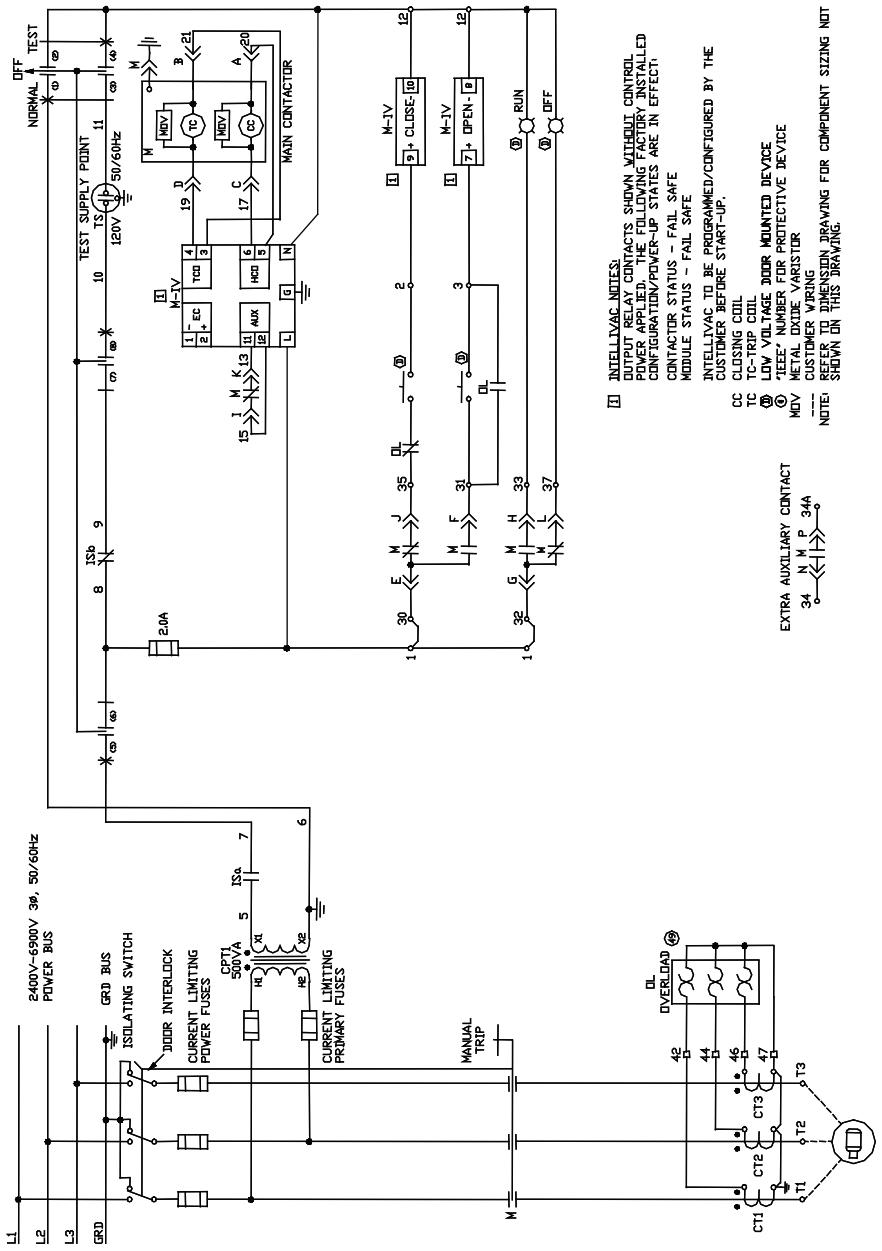


Figure 2.13 – Typical Schematic Diagram for 400A Full-Voltage Non-Reversing (FVNR) Controller *with* IntelliVAC Control and Mechanical Latch Contactor

Door Interlock Assembly

When properly installed the door interlock assembly (see Figure 2.13), used in conjunction with the isolation switch, is designed to provide the following interlocking features:

- When the isolation switch handle is in the ON position, a pin on the handle overlaps the Z-clip to prevent the door from being opened.
- When the door is closed and the isolation switch handle is in the ON position, a cover catch inside the door will be held in place by the interlock defeater lever and provide another means for holding the door closed while the unit is energized.

ATTENTION

The door interlock assembly must be installed for the isolation switch handle to restrict access to the medium voltage cell while the unit is energized. The isolation switch handle alone will not provide safety interlocking. If the door interlock assembly is not installed, the OEM assumes the responsibility for providing a means to isolate the medium voltage power cell while the unit is energized. Failure to install a medium voltage power cell isolation means can expose personnel to medium voltage resulting in severe burns, injury or death.

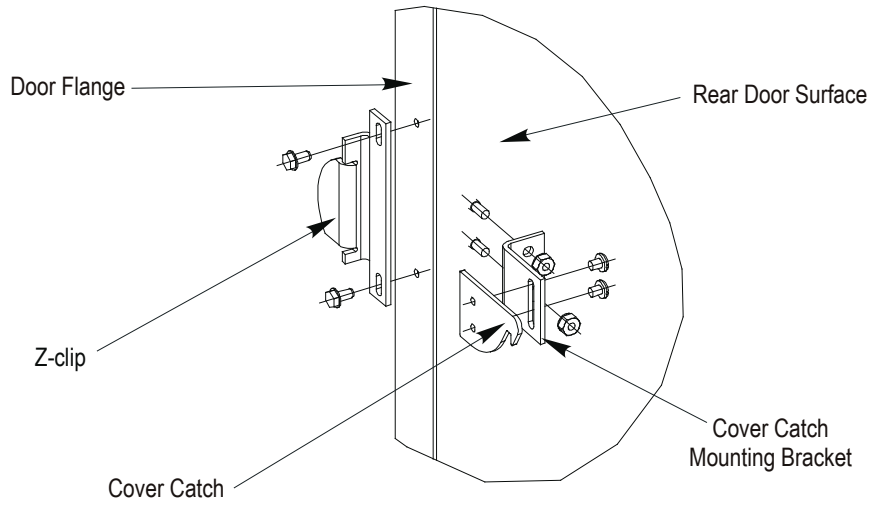


Figure 2.14 – Door Interlock Assembly

Door Interlock Assembly (cont.)

IMPORTANT All mounting hardware for the Door Interlock Assembly is supplied. Metric equivalents are provided should the user wish to substitute metric hardware.

1) See Figure 2.15 for the mounting dimensions for the door interlock assembly.
2) Drill two (2) 0.172 in. (4.6 mm) pilot holes on the right side of the door for the Z-clip.
3) Drill two (2) 0.219 in. (5.5 mm) pilot holes on the front of the door for the cover catch mounting bracket.

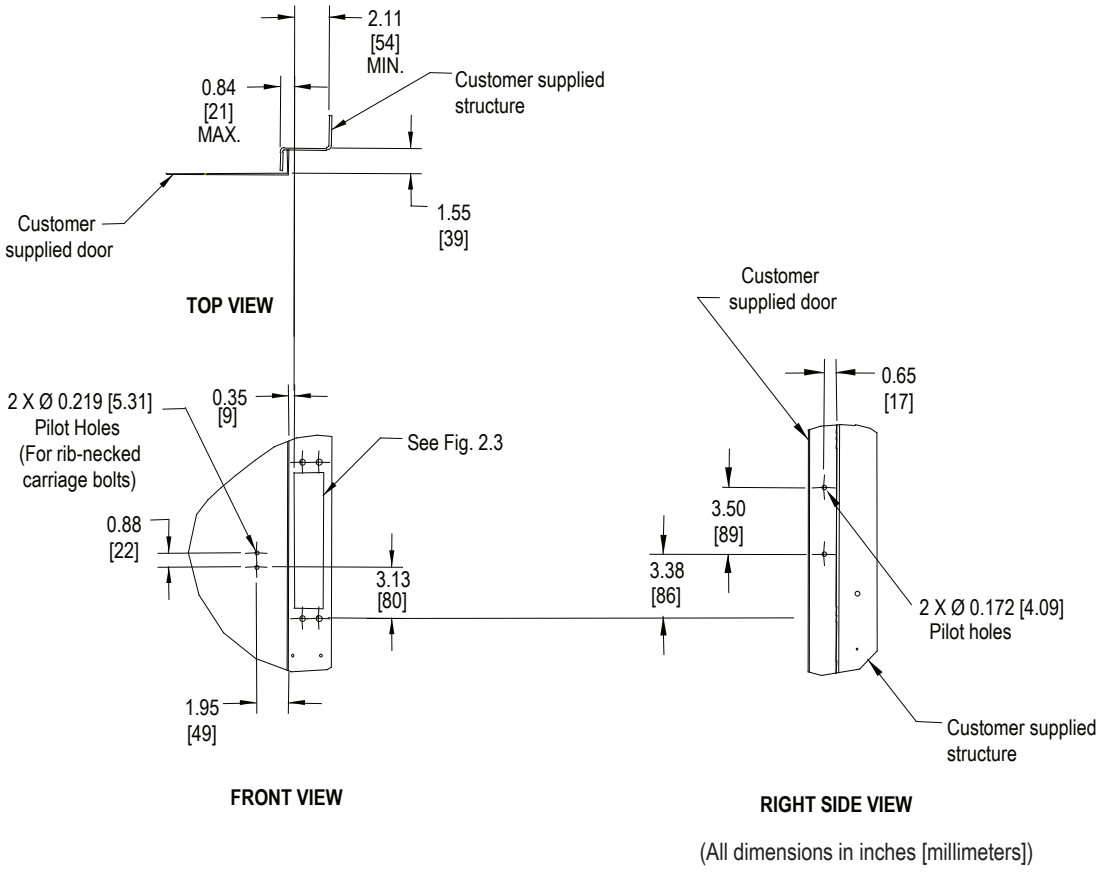


Figure 2.15 – Mounting Locations for Door Interlock Assembly

4) Attach the Z-clip using #10 (4.8 x 1.6 Type B) self-tapping screws, but do not completely tighten them.
5) Attach the cover catch mounting bracket using #10-32 x 0.500 (M5 x 0.8) rib-necked carriage screws, lockwashers and hex nuts.
6) Attach the cover catch to the cover catch mounting bracket using the supplied #10-32 x 0.219 pan-head machine screw.

IMPORTANT The pilot holes in the cover catch are threaded. To avoid damaging the thread, use the hardware provided to attach the cover catch to the mounting bracket.

7) Move the handle to the OFF position. Swing the door closed and inspect the position of the Z-clip with respect to the handle pin.
8) Set the Z-clip so that it is just above the handle pin. Do not set the Z-clip more than 0.125 in. (3 mm) above the pin. Tighten the screws.
9) Close the door and move the isolation switch handle to the ON position. If the handle will not move to the ON position, the cover catch is set too high and is not contacting the defeater lever. Open the door and set the cover catch lower. Verify correct functioning.
10) Swing the door shut and move the isolation switch handle to the ON position. Verify that the door interlock assembly is functioning properly.

Connecting Isolation Switch to Isolation Switch Handle

IMPORTANT The mechanical interlock is the primary safety mechanism preventing access to the medium voltage power cell. The mechanism also prevents opening or closing the isolation switch under load (ie. it is a non-load-break switch). A secondary electrical interlock is intended to disengage the contactor in the event of a mechanical interlock failure. See page 3-8 for additional information.

When properly connected, the isolation switch operating mechanism is designed to provide the following safety features:

- Prevent the opening of any medium voltage door interlocked with the mechanism while the handle is in the ON position and the unit is energized.
- Prevent moving the handle to the ON position and energize the unit while the medium voltage door is open.
- Disengage the contactor from the RUN mode when the handle is moved from the ON to OFF position.

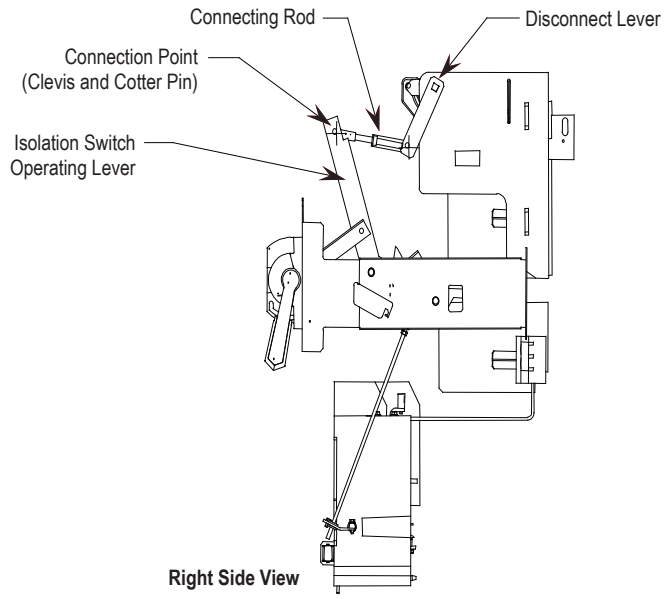


Figure 2.16 – Handle Mechanism Connection

Connecting Isolation Switch to Isolation Switch Handle (cont.)

Perform the handle mechanism connection with the handle in the OFF position. The isolation switch should be in the open position with the isolation switch blades resting against the ground bar. Refer to Figure 2.16.

1) Lengthen or shorten the threaded connecting rod until it lines up with the top hole on the isolation switch operating lever.
2) Insert a clevis pin through the holes and secure it with a cotter pin.

IMPORTANT Complete all installation procedures before beginning any adjustment procedures described in Chapter 3.

Connecting Contactor to Isolation Switch Handle

When properly connected, the contactor interlock in conjunction with the isolation switch handle mechanism, are designed to offer the following safety features:

- prevent the isolation switch from being opened while the contactor is closed and energized;
- prevent the contactor from closing if the isolation switch is in an intermediate position (ie. at halfway point during adjustment);
- disengage the contactor if the isolation switch moved to the closed position during a contactor test procedure.

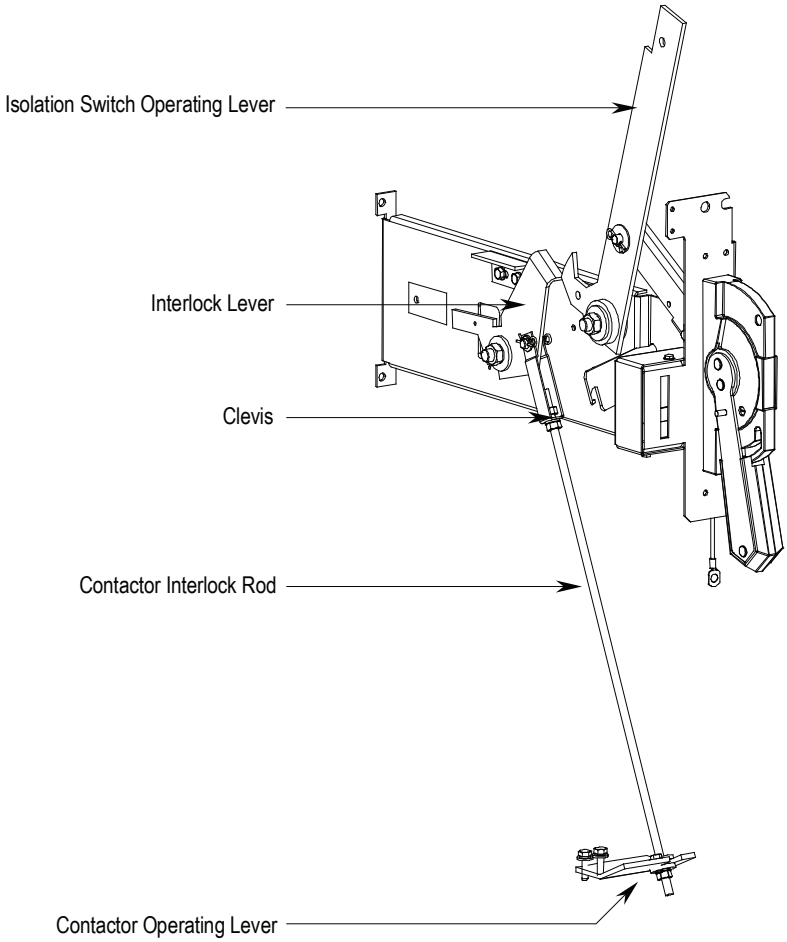


Figure 2.17 – Contactor Interlock Rod Connection

Required Hardware: (all hardware supplied)

IMPORTANT Metric hardware is not supplied; however, metric equivalents are given should the user wish to substitute metric hardware

- Two (2) 1/4 in. (M6) lock washers
- Two (2) 1/4 in. (M6) flat washers
- Two (2) 1/4-20 in. (M6 x 1.0) hex-head cap screws
- One (1) 5/16-18 in. (M8 x 1.25) nylock nut
- Two (2) 5/16 in. (M8) hex nuts
- One (1) 5/16 in. (M8) lock washer
- One (1) contactor operating lever
- One (1) 5/16-18 x 20.5 in. (M8 x 1.25 x 521 mm) contactor interlock rod

1) Attach the contactor operating lever to the flat section of the contactor shaft using two 1/4-20 in. (M6 x 1.0) hex-head cap screws with two 1/4 in. (M6) lock washers and two 1/4 in. (M6) flat washers (see Figure 2.18).

IMPORTANT The contactor operating lever is threaded for the supplied 1/4-20 hex-head cap screws. In order to substitute metric hardware, it is necessary to drill appropriate clearance holes in the contactor operating lever and use M6 x 1.0 hex-head cap screws and nuts to secure the lever to the contactor shaft.

2) From the top of the contactor interlock rod, turn a 5/16–18 in. (M8 x 1.25) hex nut at least 2 in. (50 mm) down the rod. Place one 5/16 in. (M8) lock washer over the nut.
3) Insert a 5/16–18 (M8 x 1.25) hex nut into the clevis of the door interlock lever (see Figure 2.17).
4) Turn the contactor interlock rod into the nut until approximately 1/2 in. (13 mm) of the lever extends above the nut.

Connecting Contactor to Isolation Switch Handle (cont.)

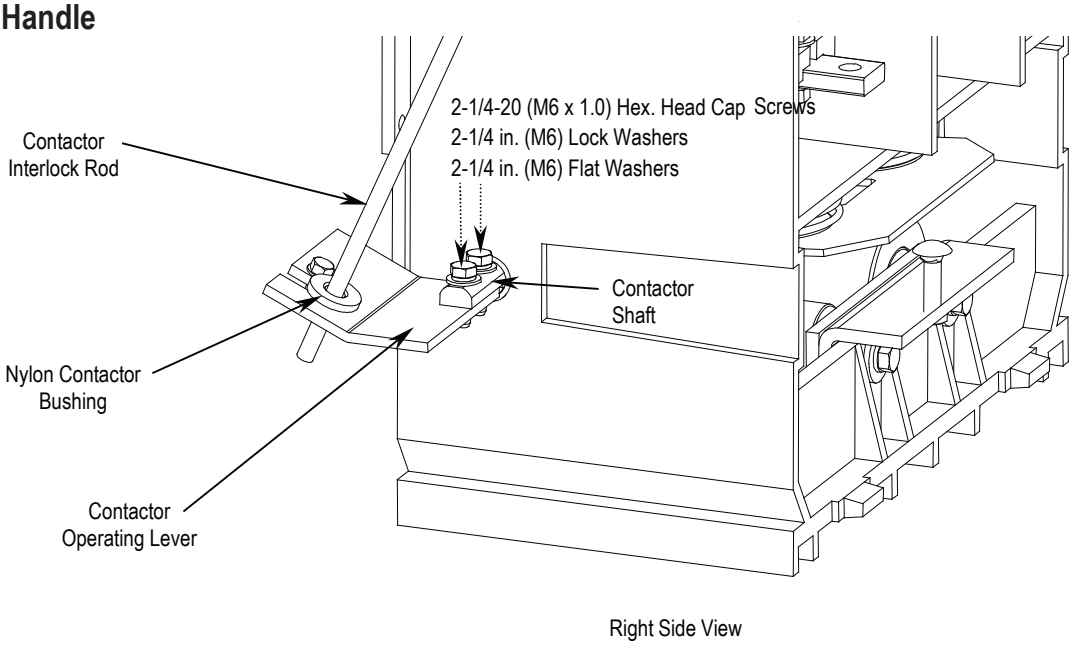

2-1/4-20 (M6 x 1.0) Hex. Head Cap Screws
2-1/4 in. (M6) Lock Washers
2-1/4 in. (M6) Flat Washers
Contactor Interlock Rod
Contactor Shaft
Nylon Contactor Bushing
Contactor Operating Lever
Right Side View

Figure 2.18 – Connecting Contactor to Isolation Switch Handle

5) Tighten the bottom nut up to the clevis.
6) Insert the lower end of the rod into the nylon contactor bushing.
7) Turn a 5/16–18 in. (M8 x 1.25) nylock nut onto the lower end of the rod and tighten it up to the flat of the contactor operating lever.

IMPORTANT Complete all installation procedures before beginning any adjustment procedures described in Chapter 3.

Electrical Connection from Contactor to Trailer Fuse Block (Clip-on Fuses)

Required Hardware:

- three (3) horizontal bus links or suitable cable and lugs (bus links are recommended to be 1/4 in. (6mm) thick and 1 in. (25mm) wide)
- three (3) 3/8-16 in. x 1 in. (M10 x 1.5 x 25mm) bolts
- three (3) 3/8-16 in. (M10 x 1.5) nuts
- three (3) 3/8 in. (M10) lock washers
- six (6) 3/8 in. (M10) flat washers

Supplied Hardware:

- three (3) 5/16-18 x 1 in. bolts
- three (3) 5/16 in. lock washers
- three (3) 5/16 in. flat washers

ATTENTION

Double-barrel, clip-on power fuses require an anti-turn bracket to maintain sufficient clearance between the power phases. Do not use such fuses without this safety feature. Failure to do so may result in injury to personnel or damage to the equipment. The brackets are supplied if specified at the time of ordering, otherwise contact Rockwell Automation to obtain the brackets. Order Allen-Bradley part number 80253-262-51. Mounting instructions are included with the kit.

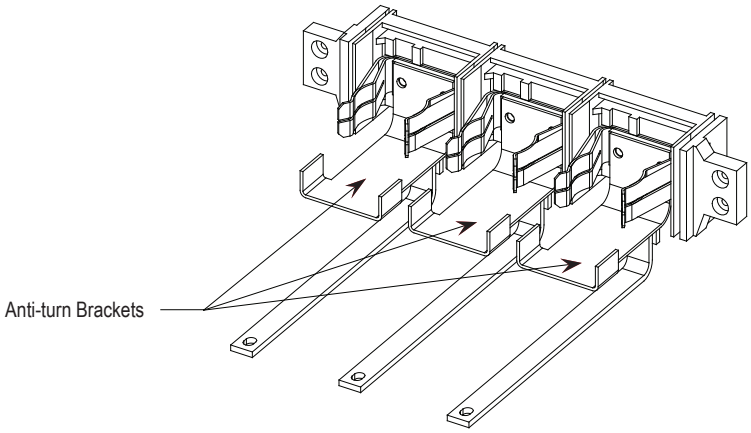


Figure 2.19 – Trailer Fuse Block with Anti-turn Brackets

Electrical Connection From Contactor to Trailer Fuse Block (Clip-on Fuses) (cont.)

1) Use the supplied 5/16 in. hardware to mount the bus link or suitable cable to the trailer fuse block (see Figure 2.20). Torque the bolts to the specifications shown on page 1-4.

IMPORTANT The trailer fuse block is equipped with 5/16-18 nuts. The supplied hardware, or equivalent, must be used to avoid damaging the thread in the nuts.

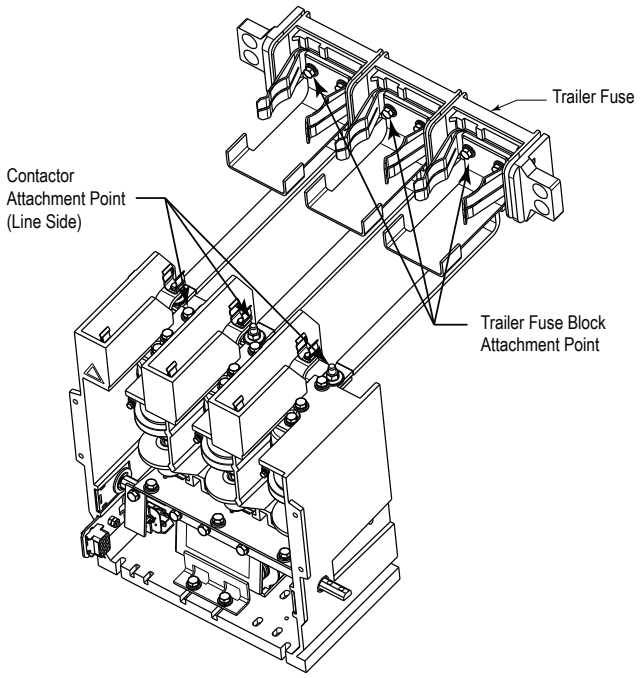


Figure 2.20 – Linking Trailer Fuse Block to Contactor (Clip-on Power Fuses)

2) Attach the bus links, or suitable cable, to the line side of the contactor (upper terminals) using 3/8 in. (M10) hardware (see Figure 2.20). Torque the bolts according to the requirments shown on page 1-4.

ATTENTION Maintain at least 3 in. (76 mm) clearance between power phase connections. Insufficient distance could cause equipment damaging power faults in the unit.

Electrical Connection from Contactor to Trailer Fuse Block (Bolt-on Fuses)

Required Hardware:

- three (3) horizontal bus links or suitable cable and lugs (bus links are recommended to be 1/4 in. (6mm) thick and 1 in. (25mm) wide)
- six (6) 3/8-16 in. x 1 in. (M10 x 1.5 x 25mm) bolts
- six (6) 3/8-16 in. (M10 x 1.5) nuts
- six (6) 3/8 in. (M10) lock washers
- twelve (12) 3/8 in. (M10) flat washers

1) Attach the bus links or cables to the line terminals on the trailer fuse block (see Figure 2.21). Torque the bolts to the specifications shown on page 1-4.

2) Attach the bus links, or suitable cable, to the line side of the contactor (upper terminals) using 3/8 in. (M10) hardware. (See Fig. 2.21) Torque the bolts according to the specifications shown on page 1-4.

ATTENTION Maintain at least 3 in. (76 mm) clearance between power phase connections. Insufficient distance could cause equipment damaging power faults in the unit.

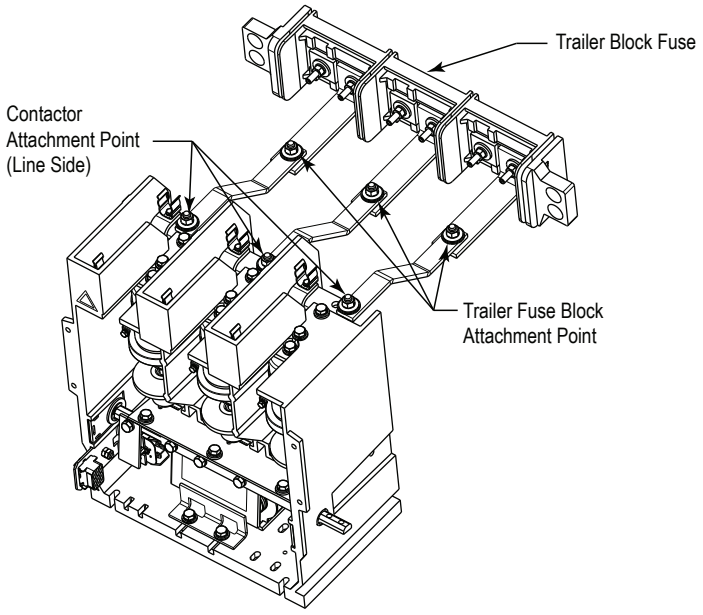


Figure 2.21 – Linking Trailer Fuse Block to Contactor (Bolt-on Power Fuses)

Incoming Line Connections

Mounting hardware is suitable for use with lugs incorporating two-hole NEMA drilling. Secure incoming cables to line terminals of the isolation switch with suitable lugs and ½ in. (M12) hardware. Torque the hardware according to the specifications shown on page 1-4.

IMPORTANT Cable size should not exceed 1-500 or 2-250 MCM per phase.

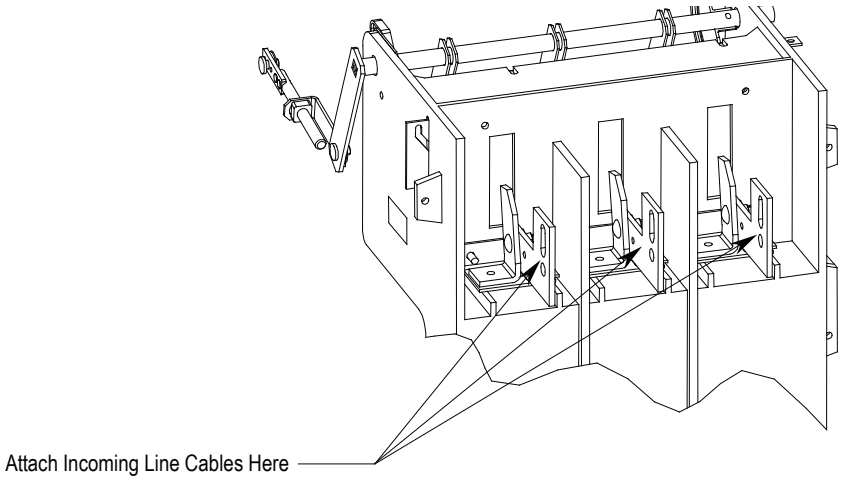


Figure 2.22 – Isolation Switch Incoming Line Connections (Rear View)

Load Connections

Secure load cables to load terminals of contactor using suitable lugs and 3/8 in.(M10) hardware. Torque the hardware according to the specifications shown on page 1-4.

IMPORTANT It is the user's responsibility to determine a suitable means of completing the power connection from the contactor to the motor ie. current transformers, power fuses, etc.

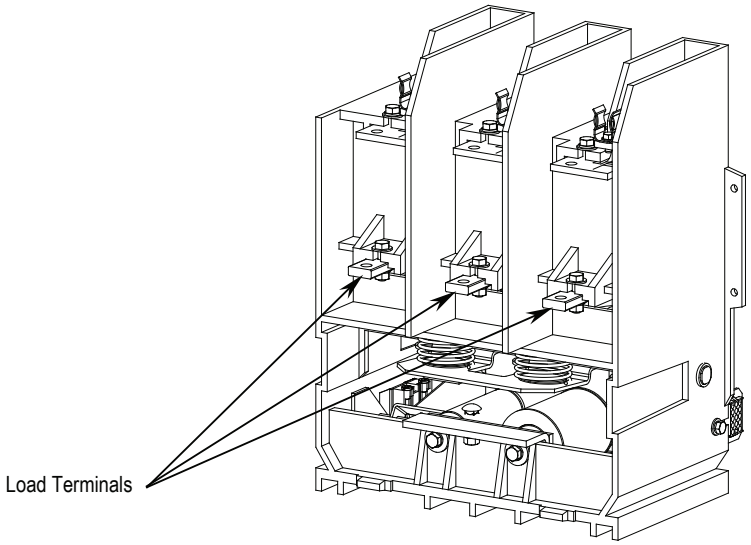


Figure 2.23 – Load Terminals - 400 A Contactor (Rear View)

Connecting Contactor to Control Power Transformer

IMPORTANT A control power transformer (CPT) is not supplied as part of the OEM starter kit. This procedure only describes how to connect wires to the contactor that will supply power to the control circuit. It is the user's responsibility to determine the correct CPT, primary fuse sizes, power wire, lugs and current transformer for the control circuit.

1) Remove the #10-32 hex head screw securing the fuse clips at the front of the contactor (see Figure 2.24).

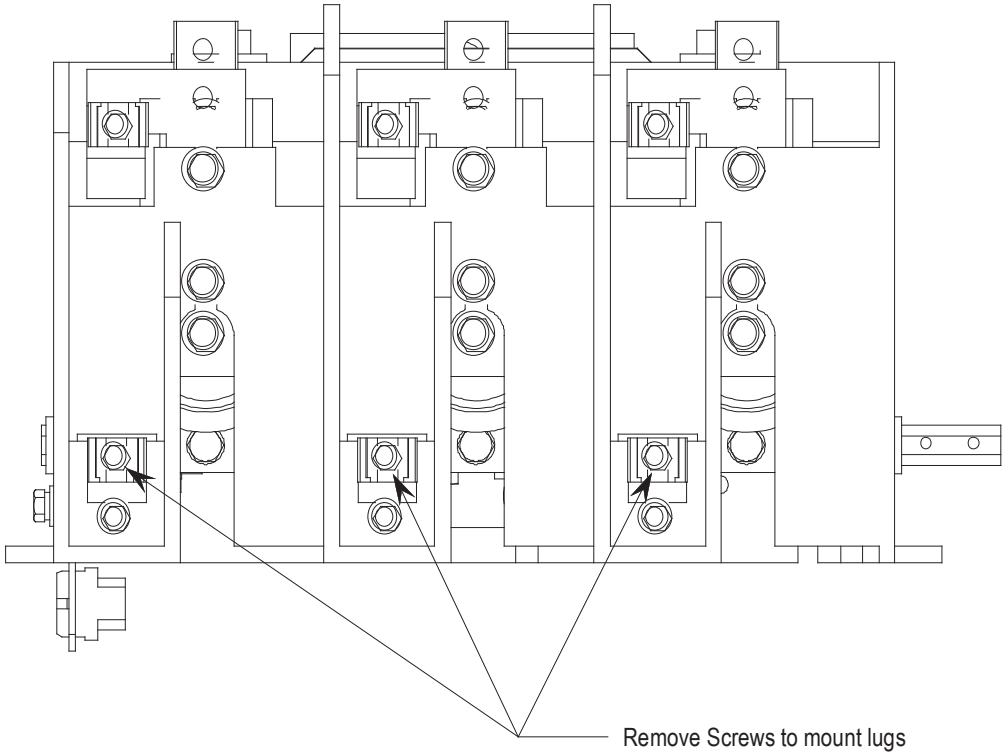


Figure 2.24 – Attaching Control Power Wires to Contactor (Top View)

2) Attach lugs with a 90-degree bend (AB part # G6666 – suitable for #12-10 AWG wire) and suitable power wire utilizing a #10 flat washer and lock washer .
3) Torque the screws to 32 in.·lbs.
4) Use wire clips provided on the contactor to fasten the control power transformer cables in position. This is required to avoid cables coming into contact with live parts and to meet dielectric test requirements.

Adjustments for 400 Amp Equipment

Door Interlock Circumvention

IMPORTANT To ensure proper functioning of the isolation switch assembly, perform the following adjustments in the order they are presented.

ATTENTION

The door interlock mechanism is designed to prevent access to the medium voltage cell while the unit is energized. When the unit is in operation, do not circumvent this interlocking safety feature. Always disconnect and lock out incoming power (see Power Lock-out Procedure, pg 3-2) before proceeding with any adjustments requiring the handle to be moved to the ON (closed) position. Failure to do so may result in electric shock causing severe burns, injury or death.

Some of the following sections may require moving the isolation switch handle to the ON position while the medium voltage door is open. The interlocking safeguards in the mechanism are designed to prevent the handle from moving to the ON position while the cabinet door is open.

- To circumvent this safety feature, use a screwdriver, or other tool, to depress the door interlock defeater lever in the switch.
- Hold the lever down while moving the handle to the ON (closed) position.

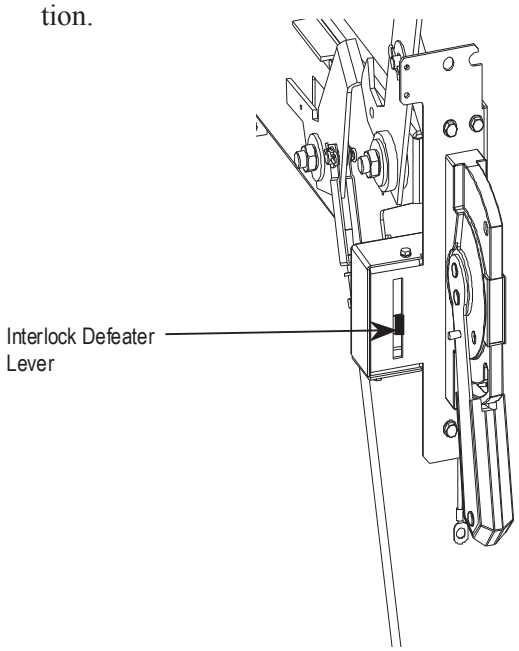


Figure 3.1 – Door Interlock Defeater Lever

Power Lock-out Procedure

ATTENTION

Always perform the power lock-out procedure before proceeding with servicing the equipment Use suitable personal protective equipment (PPE) per local codes or regulations. Failure to do so may result in severe burns, injury or death.

ATTENTION

The following procedure requires moving the isolation switch handle to the ON position. To avoid shock hazards, disconnect and lock out incoming power before proceeding with servicing the equipment. Failure to lock out incoming power will result in a live power cell once the isolation switch handle is in the ON position and may cause severe burns, injury or death. Rockwell Automation does not assume any responsibility for injuries to personnel who have not completed the following safety procedure prior to servicing the equipment.

1) Disconnect and lock out all feeder power supplies to the starter.

2) Move the isolation switch handle to the OFF position.

3) If the unit is equipped with power factor correction capacitors, stored energy must be dissipated before entering the power cell. Wait at least five minutes before entering the power cell or dissipate the power using the following procedure:

   a) Verify that the isolation switch handle is in the OFF position.
   b) Open the low voltage door.
   c) Plug the appropriate power supply (120 or 230V) into the auxiliary power receptacle on the control panel (see Figure 3.2).
   d) Move the control switch to the TEST position.

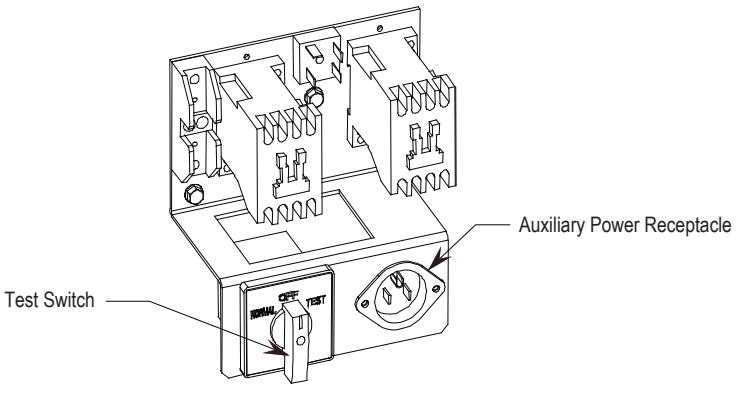


Figure 3.2 – Control Panel (120V shown)

e) Electrically operate the contactor by pushing the START button on the unit or at a remote location.

f) Disengage the contactor and move the control switch to the NORMAL position. Disconnect the external power supply.

g) Complete the Power Lock-out procedure

4) Open the medium voltage door.

5) Visually inspect that the isolation switch blades fully engage the grounding pins on the grounding bar. The isolation switch shutters should be closed (see Figure 3.3).

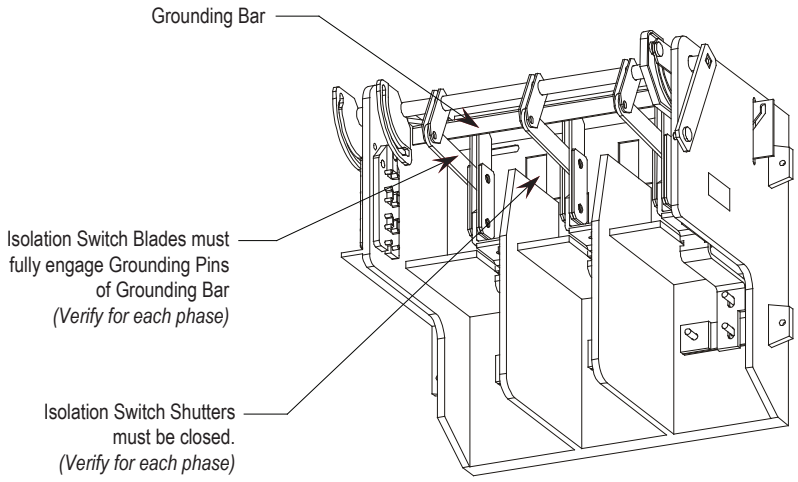

Grounding Bar
Isolation Switch Blades must fully engage Grounding Pins of Grounding Bar
(Verify for each phase)
Isolation Switch Shutters must be closed.
(Verify for each phase)

Figure 3.3 – Inspecting Isolation Switch in Open Position

6) Check the line and load sides of the contactor with a hot stick or appropriate voltage measuring device to verify that they are voltage free (see Figure 3.4).

a) Check for line-side voltage at the top vacuum bottle terminals.

b) Check for load-side voltage at the bottom vacuum bottle terminals.

Power Lock-out Procedure (cont.)

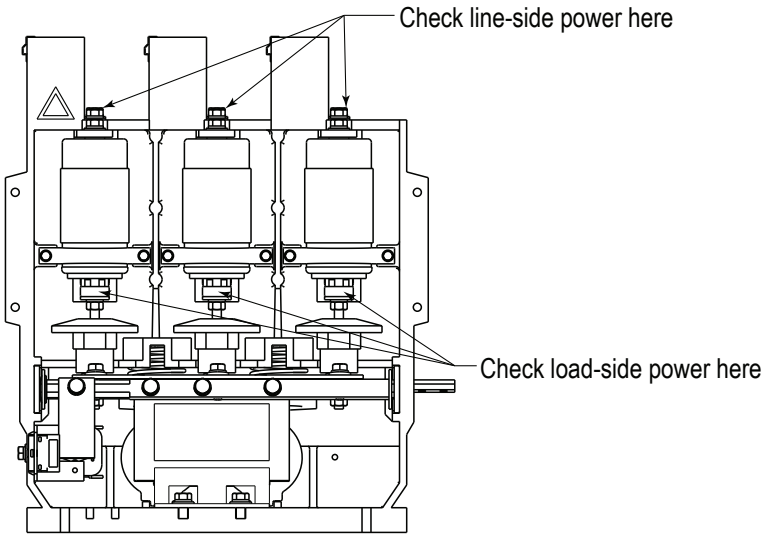


Figure 3.4 – Contactor Voltage Checkpoints

7) Use the Door Interlock Circumvention procedure described on page 3-1. to move the isolation switch handle to the ON position.

8) Check the isolation switch blades with a hot stick or appropriate voltage measuring device to verify that they are voltage free (see Figure 3.5).

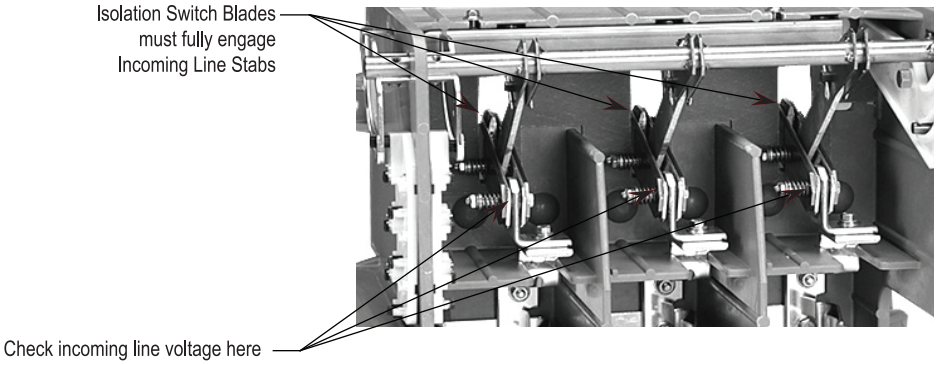


Figure 3.5 – Isolation Switch Voltage Check Points

9) Once all power circuits are verified to be voltage free, move the isolation switch handle back to the OFF position. The unit is now safe to service.

Contactor Interlock Rod Adjustment

ATTENTION To avoid shock hazards, lock out incoming power (see page 3-2) before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Complete the Power Lock-out Procedure (see Page 3-2).
2) Open the medium voltage door. Use the Door Interlock Circumvention procedure described on page 3-1 to move the isolation switch handle halfway between the OFF and ON position (see Figure 3.6). Keep the handle in this position until the adjustment procedure is completed.
3) With the contactor in the OFF position, insert a 0.050 in. (1.3 mm) feeler gauge in the gap between the interlock lever and the isolation switch operating lever. The gap must be between 0.045 in. to 0.060 in. (1.1 mm to 1.5 mm).
4) To reduce the gap distance, follow steps 5-7.

   To increase the gap distance follow steps 8-10.

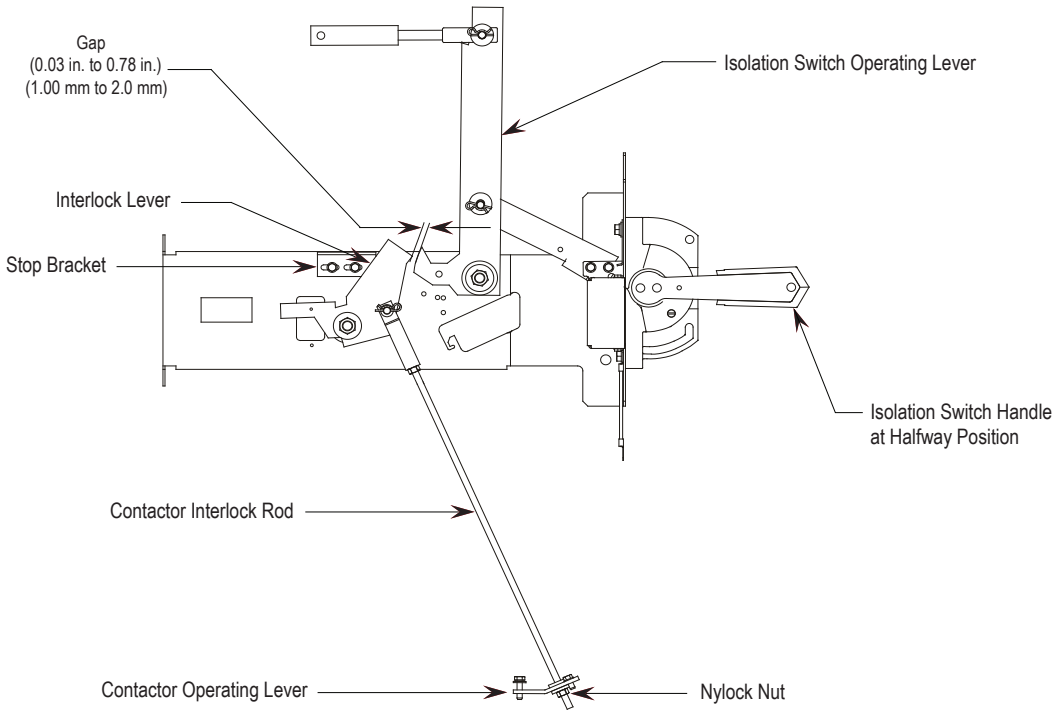


Figure 3.6 – Isolation Switch Handle Adjustments

Contactor Interlock Rod Adjustment (cont.)

To Reduce the Gap Distance

5) Loosen the two screws in the stop bracket and move the stop bracket up against the interlock lever.

6) With the feeler gauge positioned in the gap, move the interlock lever and the stop bracket closer to the isolation switch operating lever to reduce the gap space. Tighten the stop bracket screws.

7) Tighten the nylock nut until it is snug against the contactor operating lever. Do not overtighten the nylock nut as it will move the interlock lever and reduce the gap. Proceed to Step 11.

To Increase the Gap Distance

8) Loosen the two screws in the stop bracket and move the stop bracket away from the interlock lever.

9) Loosen the nylock nut until the gap reaches the desired size.

10) Move the stop bracket until it just touches the interlock lever and tighten the screws.

11) Apply Loctite 290 (or equivalent adhesive) to the stop bracket screws and torque the screws to 6 ft.-lb. (8 N•m).

12) Move the isolation switch handle to the ON position.

13) Manually close the contactor by attaching locking pliers to the contactor operating lever and pushing down until the armature plate contacts the magnetic cores (see Figure 3.7). Verify that the interlock lever overlaps the isolation switch operating lever by at least 0.125 in. (3mm) (see Figure 3.8).

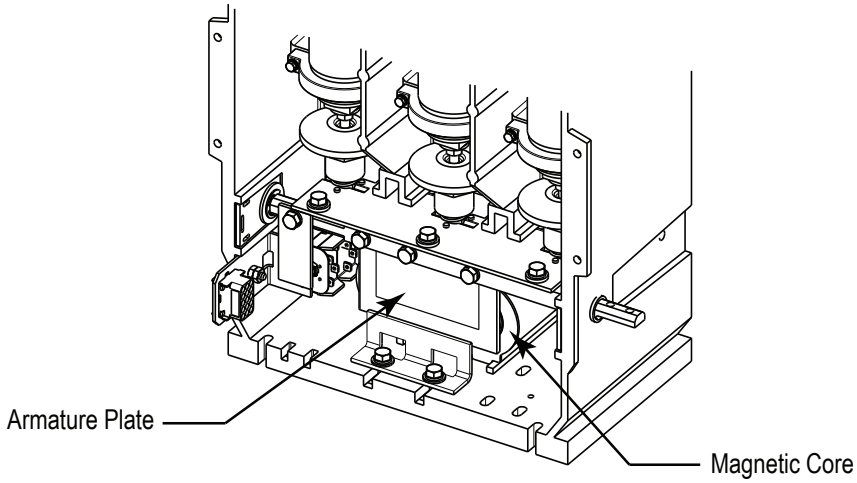


Figure 3.7 – Closing Contactor Manually (Some parts not shown)

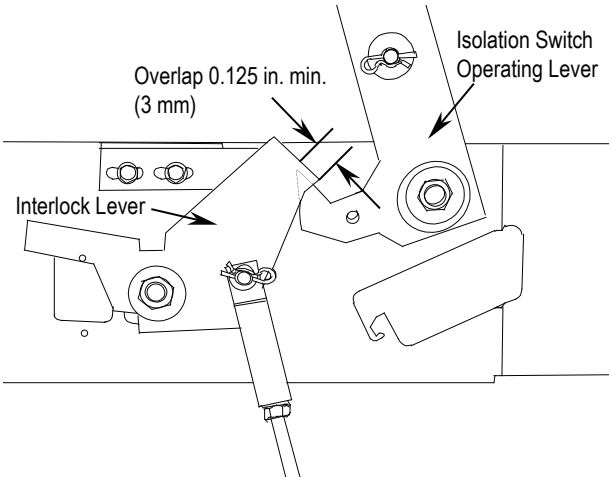


Figure 3.8 – Isolation Switch Operating Lever Overlap

14) Open the contactor. Verify that the interlock lever and the rod move freely and that the return springs move the assembly back to the starting position.

Isolation Switch Ground Adjustment

ATTENTION

To avoid shock hazards, lock out incoming power before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Move the isolation switch handle to the OFF position.

2) Inspect the grounding of the isolation switch blades. When the isolation switch handle is in the OFF (open) position, the isolation switch blades must fully engage the ground pins of the ground bar. The isolation switch blades must also be within 0.060 in. (1.5 mm) of the ground bar when the handle is in the OFF (open) position (see Figure 3.9). When the isolation switch handle is in the ON or closed position, the blades must fully engage the line stabs (see Figure 3.5).

3) To adjust the distance from the blades to the bar, disconnect the threaded connecting rod at the isolation switch operating lever (see Figure 2.16).

4) Turn the threaded connecting rod to lengthen or shorten it. This will adjust the position of the isolation switch blades in the ON and OFF position.

Isolation Switch Ground Adjustment (cont.)

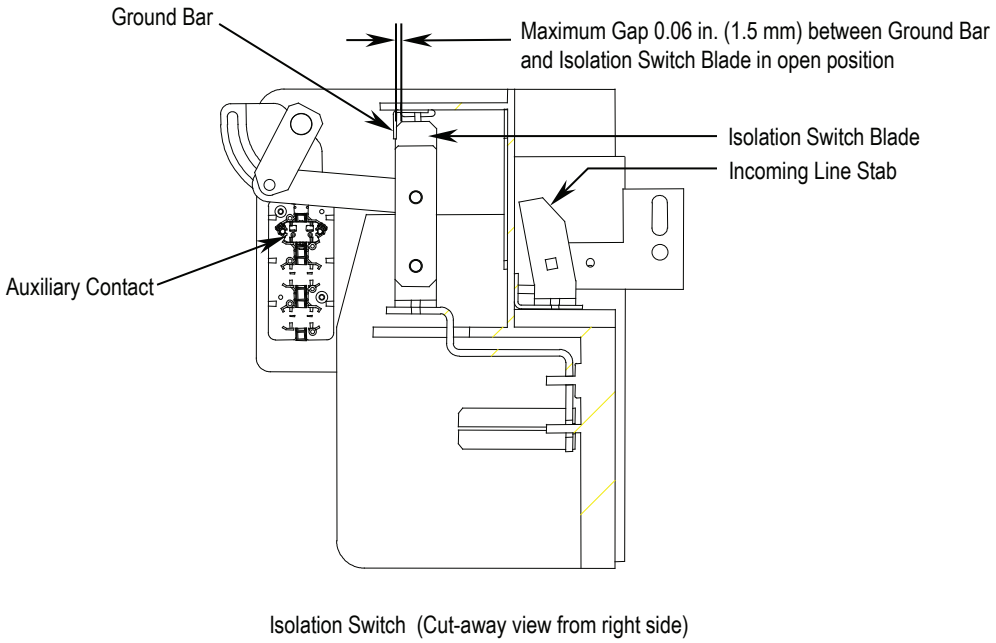

Ground Bar
Maximum Gap 0.06 in. (1.5 mm) between Ground Bar and Isolation Switch Blade in open position
Isolation Switch Blade
Incoming Line Stab
Auxiliary Contact
Isolation Switch (Cut-away view from right side)

Figure 3.9 – Isolation Switch Ground Adjustment

Isolation Switch Auxiliary Contacts

The auxiliary contacts are mounted on the left side of the isolation switch, slightly below the cams on the isolation switch shaft.

Normally open contacts (Isolation Switch a Contacts - ISa) are on the outside of the isolation switch housing, and normally closed contacts (Isolation Switch b Contacts - ISb) are on the inside of the housing.

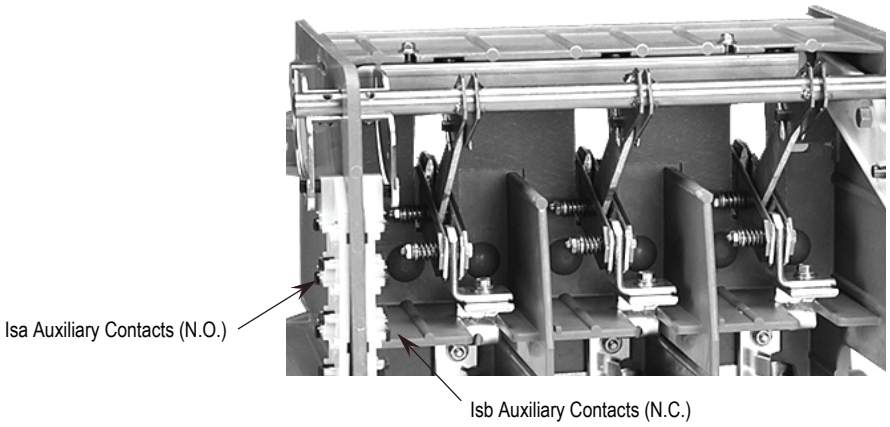


Figure 3.10 – Location of Isa and Isb Auxiliary Contacts

ISa and ISb contacts are exactly the same (700 CPM). The cam controls the normally open or normally closed status of the contacts.

Refer to Figures 2.10 to 2.13 for wiring diagrams.

Important: The Isolation Switch Ground Adjustment procedure (page 3-7) must be completed before adjusting the auxiliary contacts to ensure proper synchronization of the assembly.

Adjusting the Normally Open (ISa) Contacts

ATTENTION

To avoid shock hazards, lock out incoming power before working on the equipment. Verify with a hot stick appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Move the isolation switch handle to the ON (closed) position.

2) Loosen the bolt holding the outside cam to the shaft. Do not loosen the bolt entirely. The cam should not be able to rotate freely on the shaft.

3) Insert a 0.25 in. (6.35 mm) diameter pin into the cam groove between the cam follower and the end of the cam groove.

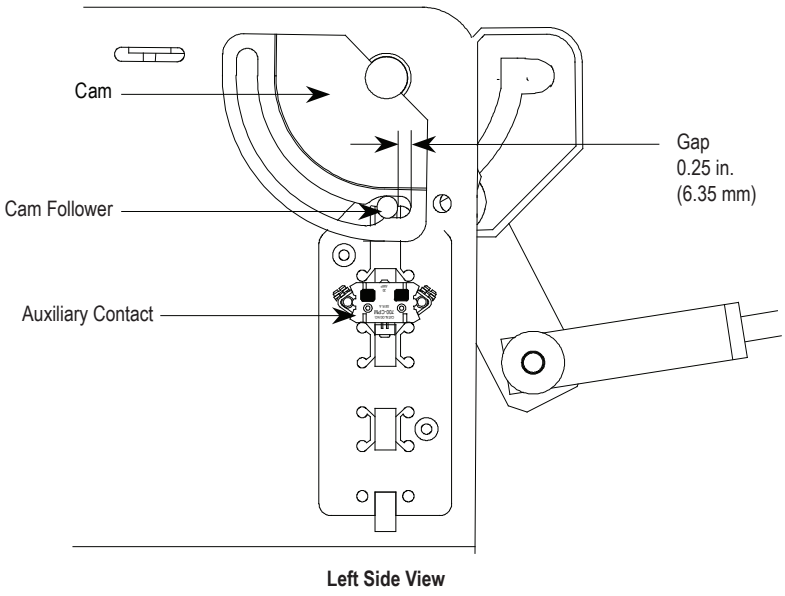


Figure 3.11 – Adjusting Auxiliary Contacts (Isa Auxiliary Contact Shown)

Isolation Switch Auxiliary Contacts (cont.)

4) Adjust the cam on the shaft so that the gap from the cam follower to the end of the cam groove is the width of the pin — 0.25 in. (6.35 mm).
5) Move the isolation switch handle to the OFF (open) position and check that nothing prevents the cam from rotating with the shaft.
6) Tighten the bolt holding the cam to the shaft. Move the isolation switch handle to the ON position and recheck the gap using the pin.
7) Verity that auxiliary contact ISa is open when the isolation switch is open. Verify that ISa contact is closed when isolation switch is closed.

Adjusting the Normally Closed (ISb) Contacts

1) Move the isolation switch handle to the OFF (open) position.
2) Loosen the bolt holding the inside cam to the shaft. Do not loosen the bolt entirely. The cam should not be able to rotate freely on the shaft.
3) Insert a 0.25 in. (6.35 mm) diameter pin into the cam groove between the cam follower and the end of the cam groove.
4) Adjust the cam on the shaft so that the gap from the cam follower to the end of the cam groove is the width of the pin — 0.25 in. (6.35 mm).
5) Move the isolation switch handle to the ON (closed) position and check that nothing prevents the cam from rotating with the shaft.
6) Tighten the bolt that holds the cam to the shaft. Move the isolation switch handle to the OFF position and recheck the gap using the pin.
7) Operate the handle several times, then recheck the 0.25 in. (6.35 mm) clearance between the end of the cam groove and the follower pin for both cams.
8) Verify that auxiliary contact ISb is closed when isolation switch is open. Verify that ISb contact is open when isolation switch is closed.

Adjusting the 'Change of State Point'

IMPORTANT This procedure sets the secondary electrical interlock. When properly adjusted, the electrical interlock is designed to open the control circuit power connections before the isolation switch opens when the handle is moved to the OFF position.

1) Once the auxiliaries have been adjusted, move the isolation switch handle to the ON position.
2) Connect a conductivity measuring device across the closed auxiliary contacts.
3) Slowly move the isolation switch handle towards the OFF position and observe the point at which the movable isolation switch blades separate from the incoming line stabs. The auxiliary contacts must change state from the closed to open position before the isolation switch blades lose contact with the incoming line stabs. This prevents the isolation switch from being opened while the unit is energized and under load conditions.

ATTENTION

The auxiliary contacts must be properly adjusted to avoid opening the isolation switch under load conditions. Improper adjustment may result in damage to the equipment and/or severe burns, injury or death to personnel.

4) If the auxiliaries do not change state before the isolation switch opens, adjust the threaded connecting rod as described in the Isolation Switch Adjustment procedure (see page 3-7).

Commissioning

Hi-Pot and Megger Test

Insulation integrity should be checked before energizing electrical equipment. Use a high voltage AC insulation tester or a Megger for this test. If a Megger is used, a 5000 volt type is recommended.

ATTENTION

Exercise caution when performing high voltage tests on the equipment. Failure to do so may result in electric shock causing severe burns, injury or death.

ATTENTION

To avoid shock hazards, lock out incoming power before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

Insulation can be tested from phase to phase and from phase to ground. The recommended level for AC Hi-Pot testing is (2 X V_{LL}) volts, where V_{LL} is the rated line-to-line voltage of the power system. The leakage current must be less than 20 mA. Record the result for future comparison testing.

If a Megger is used, it should indicate 50 megohms or greater if the unit is isolated from the line and the motor. If the unit is connected to a motor, the Megger should indicate 5 megohms or greater.

Vacuum Bottle Integrity Test

Refer to the following publications for the procedure to test vacuum bottle integrity of the Bulletin 1502 contactor:

- ***400A*** – Publication 1502-UM050_EN-P (Series D)
- ***400A*** – Publication 1502-UM052_EN-P (Series E)
- ***800A*** – Publication 1502-UM051_EN-P (Series E)

These user manuals contain detailed information on installation, adjustment and maintenance for this product.

Preliminary Checklist

Contactor Operation

ATTENTION

To avoid shock hazards, lock out incoming power before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Connect the appropriate external power supply (120 or 230 VAC) to the test receptacle in the control panel. Turn the selector switch to the TEST position (see Figure 3.2).
2) Electrically operate the contactor several times. Inspect the armature plate to verify that it fully contacts the cores (400A) or yolk plate (800A).
3) Turn the selector switch back to the OFF position and disconnect the test power supply.

Electrical Connections

1) Verify correct power cable phase sequencing and that the connections are tight. See Torque Requirements, page 1-4.
2) Verify power fuse ratings and condition.
3) Verify control fuse ratings and condition.
4) Check that components were not damaged during power cable installation, and that electrical spacings are sufficient.

Final Checks

1) Remove all tools from the cabinet. All tools and hardware used during installation and commissioning must be accounted for prior to energizing the unit.
2) Remove all temporary jumpers and grounding devices used during the installation procedures.
3) Ensure that all barriers or covers removed during installation have been securely reattached.
4) Close and secure all doors. Verify that all interlocks preventing access to medium voltage power cells are functioning correctly.

ATTENTION

Use suitable personal protective equipment (PPE) per local codes or regulations. Failure to do so may result in severe burns, injury or death.

5) Restore incoming power from main power supply.
6) Move the isolation switch handle to the ON position.
7) The controller is now ready to supply power to the load.

Maintenance

IMPORTANT Establish a maintenance and inspection schedule for the equipment. Annual servicing (or every 20,000 operations – whichever comes first) is the minimum recommended; however, extreme operating conditions may warrant additional attention.

Contactor

Refer to the following publications for detailed maintenance information on the Bulletin 1502 contactor:

- ***400A*** – Publication 1502-UM050_EN-P (Series D)
- ***400A*** – Publication 1502-UM052_EN-P (Series E)
- ***800A*** – Publication 1502-UM051_EN-P (Series E)

These user manuals contain detailed information on installation, adjustment and maintenance for this product.

Isolation Switch Mechanism Inspection and Lubrication

ATTENTION

To avoid shock hazards, lock out incoming power (see page 3-2) before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Complete the Power Lock-out Procedure (see Page 3-2).

2) Open the medium voltage door.

3) Inspect the condition of the clevis pin and cotter pins shown in Figure 5.1. Replace any worn parts.

Isolation Switch Mechanism Inspection and Lubrication (cont.)

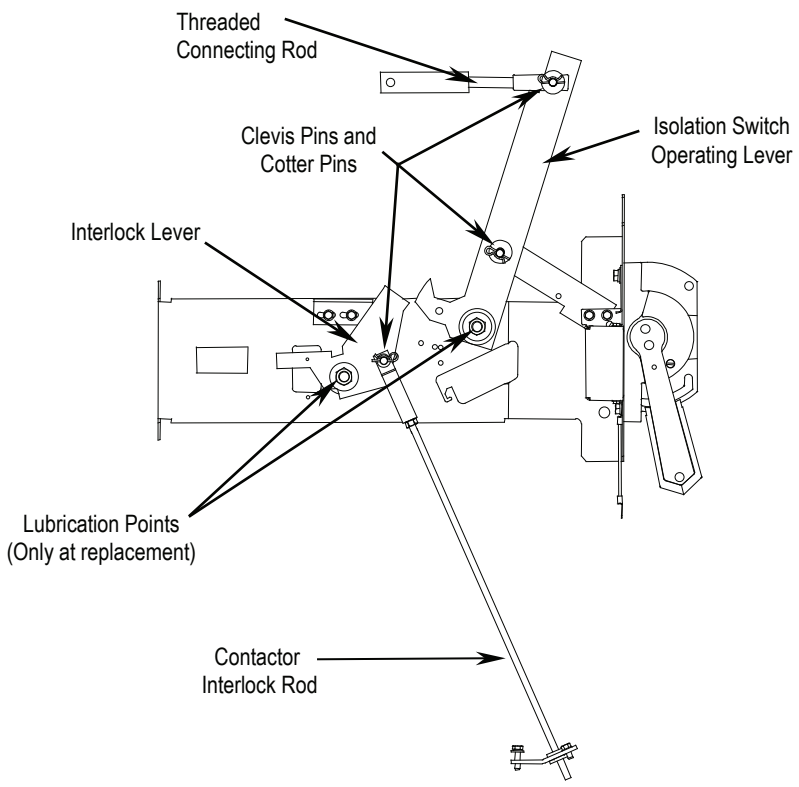


Figure 5.1 – Isolation Switch Handle Mechanism Lubrication Points

4) If it is necessary to replace the isolation switch operating lever or the interlock lever, apply Dow Corning 55 O-ring lubricant (or equivalent) to the pivot points before installing the new components (see Figure 5.1).

5) Inspect the mounting hardware on the isolation switch operating lever and contactor interlock rod (see Figure 5.1). Tighten any loose hardware.

6) Inspect the isolation switch blades and the incoming line stabs (see Figure 3.9). The mating surfaces must be clean and well lubricated.

7) Remove any dirt and dried grease.

IMPORTANT Do not scrape or file the parts. This may remove the plating and expose the underlying copper to corrosion.

8) Lubricate the isolation switch blades and the isolation switch blade pivot points with Nyogel 759G - part number T9327-105 (see Figure 5.2).

IMPORTANT Lubricate the isolation switch blades a minimum of once per year to avoid excessive wear to the components and to prevent the isolation switch blades from overheating.

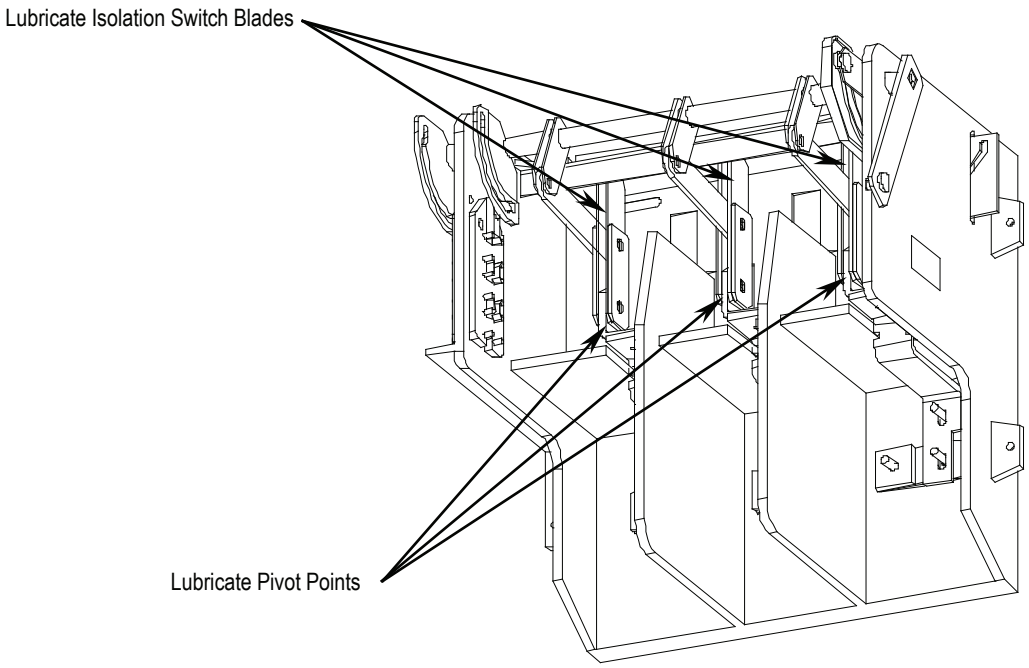


Figure 5.2 – Isolation Switch Lubrication Points

Auxiliary Contacts Inspection and Replacement

ATTENTION

To avoid shock hazard, lock out incoming power before working on the equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury or death.

1) Move the isolation switch handle to the OFF position and open the controller door.
2) Inspect the auxiliary contacts for wear, scorching or heat damage. Replace any damaged contacts. The contacts have a mean time between failure (MTBF) rating of 20 million operations if used within the operating specifications.
3) To remove the contact, turn both of the D-head fasteners until the flat sections are aligned with the edge of the contact (See Figure 5.3).
4) Remove the contact from the housing.
5) Disconnect the wires from the auxiliary contact.
6) Reverse the procedure to replace the auxiliary contact.
7) Ensure the contact is correctly positioned into the contact carrier (See Figure 5.3).

Auxiliary Contacts Inspection and Replacement (cont.)

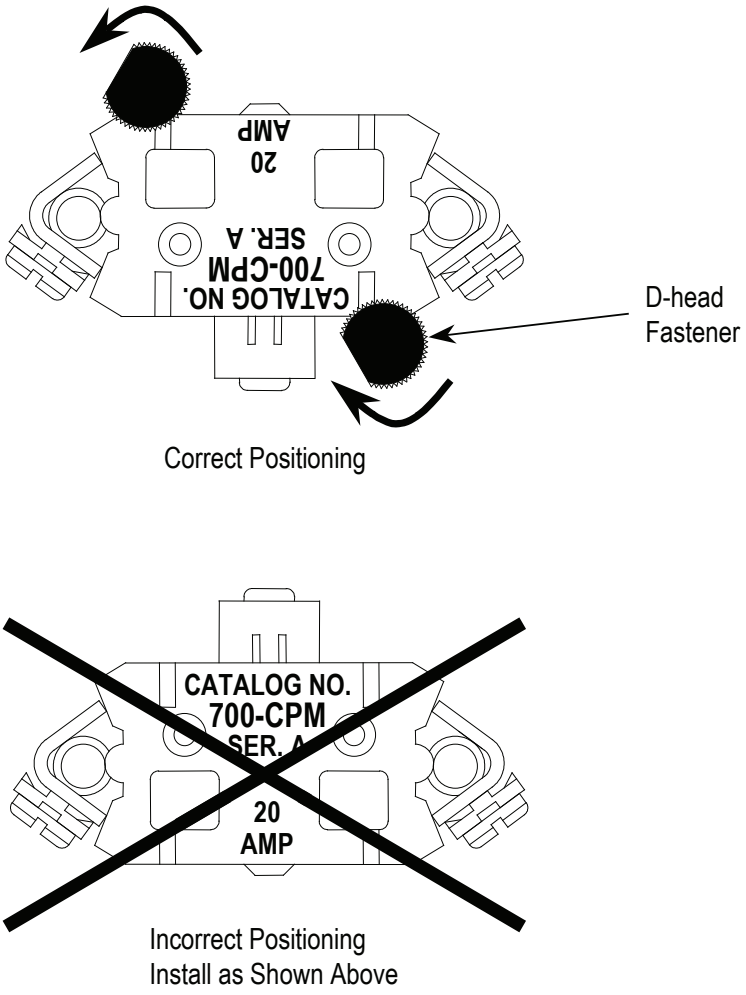


Figure 5.3 – Auxiliary Contact Orientation

Spare Parts

Part Number	Description	Recommended Stocking Qty.
1503C-E4D	Low Voltage Control Panel – 120V AC ❶❷	1
1503C-E4E	Low Voltage Control Panel – 230V AC ❶❷	1
40266-515-03	20 Amp Isolation Switch Auxiliary Contact (700 CPM)	2
80145-566-67	Isolation Switch Blade Assembly – 400A (Ser. C)	3
80154-422-01	Auxiliary Switch Cam Follower	2
80154-542-51	Auxiliary Switch Housing Assembly	2
T9327-105	Nyogel 759G Isolation Switch Lubricant	1
80144-491-02	Fuse Extractor (For Clip-on Power Fuses)	1

❶ The Low Voltage Control Panel includes the following: CR1 relay, CR2 Relay, rectifier, MOV assembly, test switch, test plug.
❷ Refer to Publication 1503-UM051_-EN-P or 1503-UM052_-EN-P for spare part information for IntelliVAC control modules.

Refer to the following publications for information on spare parts for the Bulletin 1502 medium voltage 400A contactor (120V and 230V):

- ***400A*** – Publication 1502-UM050_EN-P (Series D)
- ***400A*** – Publication 1502-UM052_EN-P (Series E)
- ***800A*** – Publication 1502-UM051_EN-P (Series E)

These user manuals contain detailed information on installation, adjustment and maintenance for this product.

OEM Kit Chart

Table A.1 – Items That Should be Included with the Power Cell and Frame

Final Part Number	Qty	Description	Saleable Part Number	RA Internal Part Number
1503F-E4GCD	1	400 Amp, 2.3 – 5.0 kV, Electrically held, Clip On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-E4GCD	80158-951-61
	1	Electrically Held 120V Control panel	1503C-E4D	80158-143-51
1503F-E4GCE	1	400 Amp, 2.3 – 5.0 kV, Electrically Held, Clip On Fuse, Electro-Mechanical, 220-230VAC Control Frame	1503F-E4GCE	80158-951-65
	1	Electrically Held 230V Control Panel	1503C-E4E	80158-143-53
1503F-E4GCU	1	400 Amp, 2.3 – 5.0 kV, Electrically Held, Clip On Fuse, IntelliVAC, 110-120VAC Control Frame	1503F-E4GCU	80178-373-58
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHE4V	80178-142-57
1503F-E4GBD	1	400 Amp, 2.3 – 5.0 kV, Electrically Held, Bolt On Fuse, Electro-Mechanical, 110-120VAC Control Frame	1503F-E4GBD	80158-951-59
	1	Electrically Held 120V Control Panel	1503C-E4D	80158-143-51
1503F-E4GBE	1	400 Amp, 2.3 – 5.0 kV, Electrically Held, Bolt On Fuse, Electro-Mechanical, 220-230VAC Control Frame	1503F-E4GBE	80158-951-63
	1	Electrically Held 230V Control Panel	1503C-E4E	80158-143-53
1503F-E4GBU	1	400 Amp, 2.3 – 5.0 kV, Electrically Held, Blot On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-E4GBU	80178-373-55
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHE4V	80158-142-57
1503F-M4GCD	1	400 Amp, 2.3 - 5.0 kV, Mechanical Latch, Clip On Fuse, Electro-Mechanical, 110-120VAC Control Frame	1503F-M4GCD	80158-951-69
	1	Mechanical Latch 120V Control Panel	1503C-M4D	80158-143-52
1503F-M4GCU	1	400 Amp, 2.3 – 5.0 kV, Mechanical Latch, Clip On Fuse, IntelliVAC< 110-120 VAC Control Frame	1503F-M4GCU	80178-373-63
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness – IntelliVAC	1503-WHM4V	80158-142-52
1503F-M4GBD	1	400 Amp, 2.3 – 5.0 kV, Mechanical Latch, Blot On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-M4GBD	80158-951-67
	1	Mechanical Latch 120V Control Panel	1503C-M4D	80158-143-52
1503F-M4GBU	1	400 Amp, 2.3 – 5.0 kV, Mechanical Latch, Blot On Fuse, IntelliVAC< 110-120VAC Control Frame	1503F-M4GBU	80178-373-61
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness – IntelliVAC	1503-WHM4V	80158-142-52
1503F-E4KCD	1	400 Amp, 5.1 – 6.9 kV, Electrically Held, Clip On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-E4KCD	80158-951-62
	1	Electrically Held 120V Control Panel	1503C-E4D	80158-143-51
1503F-E4KCE	1	400 Amp, 5.1 – 6.9 kV, Electrically Held, Clip On Fuse, Electro-Mechanical, 220-230 VAC Control Frame	1503F-E4KCE	80158-951-66
	1	Electrically Held 230V Control Panel	1503C-E4E	80158-143-53
1503F-E4KCU	1	400 Amp, 5.1 – 6.9 kV, Electrically Held, Clip On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-E4KCU	80178-373-68
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
		Wire Harness-IntelliVAC	1503-WHE4V	80158-142-57
1503F-E4KBD	1	400 Amp, 5.1 – 6.9 Electrically Held, Blot On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-E4KBD	80158-951-60
	1	Electrically Held 120V Control Panel	1503C-E4D	80158-951-51
1503F-E4KBE	1	400 Amp, 5.1 – 6.9 kV, Electrically Held, Bolt On Fuse, Electro-Mechanical, 220-230 VAC Control Frame	1503F-E4KBE	80158-951-64
	1	Electrically Held 230V Control Panel	1503C-E4E	80158-143-53

Table A.1 – Items That Should be Included with the Power Cell and Frame (cont.)

Final Part Number	Qty	Description	Saleable Part Number	RA Internal Part Number
1503F-E4KBU	1	400 Amp, 5.1 – 6.9 kV, Electrically Held, Blot On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-E4KBU	80178-373-65
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHE4V	80158-142-57
1503F-M4KCD	1	400 Amp, 5.1 – 6.9 kV, Mechanical Latch, Clip ON Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-M4KCD	80158-951-70
	1	IntelliVAC Base	1503C-M4D	80158-143-52
	1	Wire Harness-IntelliVAC	1503F-M4KCU	80178-373-73
1503-M4KBD	1	400 Amp, 5.1 – 6.9 kV, Mechanical Latch, Bolt On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503VC-BMC5	80178-370-52
	1	Mechanical Latch 120V Control Panel	1503-WHM4V	80158-142-59
1503F-M4KBU	1	400 Amp, 5.1- 6.9 kV, Mechanical Latch, Blot On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-M4KBD	80158-951-68
	1	IntelliVAC Base	1503C-M4D	80158-143-52
	1	Wire Harness-IntelliVAC	1503-WHM4V	80158-142-59
1503F-E6GBD	1	600 Amp, 2.3 – 5.0 kV, Electrically Held, Blot On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-E6GBD	80158-333-57
	1	Electrically Held 120V Control Panel	1503FC-E8D	80158-143-54
1503F-E6GBU	1	600 Amp, 2.3 – 5.0 kV, Electrically Held, Blot On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-E6GBU	80178-374-52
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHE8V	80178-142-58
1503F-M6GBD	1	600 Amp, 2.3 – 5.0 kV, Mechanical Latch, Blot On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-M6GBD	80158-333-60
	1	Mechanical Latch 120V Control Panel	1503C-M8D	80158-143-60
1503F-M6GBU	1	600 Amp, 2.3 – 5.0 kV, Mechanical Latch, Blot On Fuse, IntelliVAC 110–120 VAC Control Frame	1503F-M6GBU	80178-374-55
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHM8D	80158-142-55
1503F-E6KBD	1	600 Amp, 5.1 – 6.9 kV, Electrically Held, Bolt On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-E6KBD	80158-333-58
	1	Electrically Held 120V Control Panel	1503C-E8D	80158-143-54
1503F-E6KBU	1	600 Amp, 5.1 – 6.9 kV, Electrically Held, Bolt On Fuse, IntelliVAC, 110-120 VAC Control Frame	1503F-E6KBU	80178-374-57
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHE8V	80158-142-58
1503F-M6KBD	1	600 Amp, 5.1 – 6.9 kV, Mechanical Latch, Bolt On Fuse, Electro-Mechanical, 110-120 VAC Control Frame	1503F-M6KBD	80158-333-61
	1	Mechanical Latch 120V Control Panel	1503C-M8D	80158-143-55
1503F-M6KBU	1	600 Amp, 5.1 – 6.9 kV, Mechanical Latch, Bolt On Fuse, IntelliVAC 110-120 VAC Control Frame	1503F-M6KBU	80178-374-60
	1	IntelliVAC Base	1503VC-BMC5	80178-370-52
	1	Wire Harness-IntelliVAC	1503-WHM8D	80158-142-55

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Publication 1503-IN050E-EN-P – June 2013
Supersedes Publication 1503-IN050D-EN-P – June 2012
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